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NEW NUCLEAR DATA

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Table 1. Radioactivity, Levels, Abundances, Moments
Table 2. Neutron Cross Sections
Table 3. Ground State Q's
Table 4. Mass Differences and Ratios

INTRODUCTION

In this issue Nuclear Science Abstracts presents the fourth annual cumulation of new nuclear data prepared by the Nuclear Data Group which is currently sponsored by the National Research Council and supported by the Atomic Energy Commission and the National Bureau of Standards. The results collected here have been taken from journals which have become available from about October 1954 to October 1955. As the list of the specific journals abstracted given below shows, the coverage in this cumulation begins where it left off for the 1954 list.

Earlier 1955 nuclear data summaries have been published in the quarterly numbers of Volume 9 of Nuclear Science Abstracts: 6B (March 31), 12B (June 30, semi-annual cumulation), and 18B (September 30). These summaries, together with the material which came to hand since 18B was prepared, are included in the present one. The aim is to make the reporting of new data in all the lists continuous. Any apparent gaps in coverage are due to oversights or to delays in the receipt of certain journals, and are filled in as promptly as possible.

Nuclear Data Cards: As the current literature is surveyed, the new nuclear results are first printed on 3- by 5-inch cards which are collected into sets of 100 to 150 cards each month. Individuals, laboratories, or libraries may subscribe to the card sets directly by applying to the Publications Office, National Research Council, 2101 Constitution Avenue, N.W., Washington 25, D. C. The price, based on actual mechanical costs, is currently $20 per year domestic and $30 per year foreign (air mail postage included for foreign but not for domestic subscriptions.)

Nuclear Level Schemes: The first section of a new comprehensive nuclear data table prepared by the Nuclear Data Group has been published this fall by the Government Printing Office. The aim of Nuclear Level Schemes is to provide a revision and expansion of Nuclear Data which was issued in 1950 as Circular 499 of the U. S. National Bureau of Standards. It will be published in five or six sections, each one of which will be issued upon completion. The first section, now available, begins with mass number A = 40 and includes known nuclei with mass number up to and including A = 92, covering roughly $_{20}$Ca through $_{40}$Zr. The second section will cover approximately the next 20 elements, the third 20 more, and so on.

The style of presenting data in Nuclear Level Schemes is very similar to that used on the Nuclear Data Cards and in the cumulated lists of Nuclear Science Abstracts. The cards, or the lists, will thus provide a convenient means of keeping this table up to date.

Nuclear Level Schemes (A = 40 to A = 92) can be ordered from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price $1.75, 240 pages, paperbound. Remittance should be by check or money order.

NUCLEAR DATA STATISTICS

Because of the time required for abstracting and publication, the data reported in this cumulation are not those which appeared in the literature during the calendar year 1955, but rather in the twelve months from October 1954 to October 1955. In the following comments these twelve months will be referred to as the 1955 period, or even more loosely, as 1955.

The amount of new nuclear data continues to grow. The number of "items" reported in the 1955 period has increased by approximately 20% over that for 1954 which in turn increased by approximately 30% over that for 1953. By an "item" is meant the information on a particular nucleus given with its reference in the main section of the cumulation which is devoted to Radioactivity, Levels, Abundances, Moments.

The following table gives an idea of the growth in the last few years of the number of such "items" and of the individual measurements listed under Neutron Cross Sections, Ground State Q's, and Mass Differences and Ratios.

INCREASE IN NUCLEAR DATA

	Number of items on Radioactivity, etc.	Number of Cross Sections	Number of Ground State Q's	Number of Mass Differences	Total NSA Pages
1952*	1186	264	205	139	52
1953	1026	562	140	133	74
1954	1328	308	107	112	99
1955	1581	425	107	18	141

* 15 months

SOME 1955 HIGHLIGHTS

When any cumulation of data has been made, certain features inevitably strike the compilers as being particularly interesting or noteworthy. This year the members of the Nuclear Data Group decided to list those trends or individual items which seemed to them the most striking or significant. Although it was realized that choices for such a list are strongly biased by personal interests, it was felt, nevertheless, that their inclusion here would help to make this long data cumulation more useful and interesting.

During this year a great deal of interest was centered on the question of the existence of low-lying levels since the numbers and position of such levels are important for nuclear models and coupling schemes. Some level schemes in the very light element region became considerably simpler than they were before, others more complicated. Some specific cases are mentioned below.

The present evidence is against the existence of a first excited state in He^4 at ~21 Mev.

Additional evidence has been found for the 6.6 level in Li^7 and its counterpart at 6.3 in the mirror nucleus Be^7. As pointed out by Inglis[1] these two levels are not to be expected on a central model but can be accounted for by an alpha-particle picture.

Evidence is increasing that there is only one low-lying level in Be^8 below 8 Mev, namely that at 2.9. This is to be expected from the shell model or from the picture of alpha-model rotational states.[1]

Two new levels have been found in Be^9 at 1.8 and 3.0 which would fit into the intermediate coupling picture.[1] However, some doubt as to the existence of the lower one is cast by more recent work which could not be included in the cumulation.[2]

Additional evidence has been found for the existence and 0^+ character of the 7.65 level in C^{12} which is important in theories of element formation by the $Be^8(\alpha,\gamma)$ process.

A careful search revealed no evidence for a 2^- level at ~7 Mev in O^{16} which is predicted by the alpha-particle model.[1]

The surprising $1/2^-$ character of the first excited state of F^{19} was definitely established during the 1955 period. The spin-parity assignment of the second excited state is $5/2^+$. The magnetic moment of this $5/2^+$ state has now been measured and found to be near the Schmidt line. Intensive study of the higher levels of this nucleus has begun.

There was a good deal of work on the disintegration of C^{12} into three alpha particles. The fact that Be^8 is usually formed as an intermediate step in most cases seems to be established but a clear picture of the mechanism of this reaction has not yet emerged.

The inelastic scattering of high energy electrons (180 Mev) has been used to study the levels and charge distribution of C^{12} and S^{32}. Even the 7.65 level of C^{12} is produced by this process.

A number of d,p angular correlations were measured for the light elements particularly at deuteron energies below 1 Mev where effects due to resonance in the compound nucleus show up. (O^{17}, B^{11}). There is as yet no agreement on the way to analyze such data. The B^{11} results are particularly discrepant with respect to the parity of the 4.46 level, a quantity which is important for the coupling picture.[1]

A strong resonance peak in the O^{16} (γ,p) reaction has been found at 14.7 and the suggestion made[3] that this level is the lowest state of surface oscillation in O^{16}.

The 1955 period saw the determination of the decay properties of the long-lived Al^{26} which is sure to have great practical importance. The long-lived T=0 state was shown to lie 0.222 Mev below the 6.7[5] T=1 state.

Greater precision in the measurement of the energy of capture gamma rays has been attained through the development of a Compton magnetic spectrometer. Results from the use of this instrument are given for Na, S, and Cl.

A new accurate determination by counting methods of the electron-capture branching ratio in K^{40} (12.4 ± 0.2%) is higher than the value found from geological measurements (9%) or from the average of older counting work (10.8%).

There is still some doubt about the level scheme of Ca^{43} as found from the decay of K^{43} and Sc^{43} and the Ca^{42} (d,p) reaction. This scheme has become of great importance for comparison with theoretical calculations.[4]

In the study of the gamma continuum in electron capture processes, the emphasis has shifted from the high to the low energy end of the photon distribution. The high intensity in the very low energy region observed in the cases of A^{37}, V^{49}, Fe^{55}, Ge^{71} and Cs^{131} is consistent with the theory of Glauber and Martin[5] in which the capture of electrons with non-zero angular momentum is taken into account.

Measurement of the circular polarization of gamma rays has proved to be a helpful tool in level studies of Zn^{65}, Fe^{57}, and Cu^{64}.

The continuing search for double beta decay has again yielded only negative results (Mo^{92}, Mo^{100}, Cd^{106}, Cd^{116}). For Ca^{48} positive results are listed in this cumulation. However, it was reported informally by H. W. Fulbright at the Ann Arbor meeting that these could not be confirmed.

The value of the half-life of the important fission product Sr^{90} has been changed considerably from 20 to 28 years. This new result is closer to the early one of 25 years.

The half-lives of Tc isotopes have been of great interest since the discovery of Tc lines in stellar spectra. During 1955 the decay properties of a Tc^{98} with a half-life of $\sim 10^4$ years were established. A long-lived Tc^{98} (presumably the same one) was detected by mass spectrometer among the reaction products of Mo bombarded by protons. Evidence for the existence in nature of Tc^{98} (which seems to be in conflict with the above) was also reported by two groups of workers in 1955.

Negative results have come from searches for radioactivity in a number of nuclei known to be, or suspected of being, unstable with respect to their neighboring isobars (Ca^{48}, V^{50}, Zr^{96}, Mo^{100}, Cd^{113}, In^{113}, Sb^{123}, Te^{123}, Te^{130}, Nd^{150}, Re^{187}, Os^{187}, Pb^{205}). On the other hand, the hole which has existed in nuclear charts at Mn^{53} has finally been filled by a Mn isotope decaying by electron capture with a half-life reported to be 140 years.

In the 1955 period accurate measurements of nuclear moments were made for 42 stable and 22 unstable nuclei. In addition indications have been found for magnetic octopole moments, μ_3, in Ga^{69} and Ga^{71} and for electric hexadecapole moments, q_4, in Sb^{121} and Sb^{123}.

Improved techniques have resulted in a great increase in the information on the Breit-Wigner parameters of well resolved neutron resonances. Systematization of the data by the Brookhaven group[6] shows that for a single nucleus Γ_γ is relatively constant, while there is a wide variation in the reduced neutron width, Γ_n°.

The percent of the data devoted to the rare earths, which comprise 14% of the elements, has been steadily increasing, amounting to 7.5% in 1953, 9% in 1954, and 10.5% in 1955. During this last year the availability of high purity rare earths and of some separated isotopes made possible the mass assignment of a number of radioactive isotopes (particularly those of Pr and Tb) as well as the study of the rotational properties of levels (Nd, Sm, Gd) and the isotopic assignment of neutron resonances (Ce, Sm, Eu, Tb, Ho, Tm, Lu).

It has long been a puzzle that the Tl^{204} decay did not lead to a 0.375 gamma from the level believed to exist at 0.375 in Pb^{204}. A more detailed study of the decay of 68^{m} Pb^{204} now shows that such a gamma ray is not to be expected since the first excited level of Pb^{204} lies at 0.899 and the second 0.375 Mev above this.

Internal conversion coefficients have been computed taking account of the effect of the finite size of the nucleus. These calculations[7] indicate that some gamma transitions, previously assigned an M4 character, are E5, e.g., Sr^{87}. At $Z = 80$ the M1 internal conversion coefficient is 68% of that computed by Rose (see Au^{198}).

The half-lives of a number of fast E2 transitions have been measured. The comparative lifetimes of these transitions show a remarkably smooth variation between the neutron numbers 82 and 126. Half-lives determined from Coulomb excitation are in very good agreement with directly measured half-lives. (Sm^{152}, Gd^{154}, Hf^{180}, Hf^{176}, W^{182}, etc.)

The occurrence in nature of one more long-lived nuclear species, Ta^{180} (relative abundance 0.0123%), has been reported from mass spectrometer studies. The existence of this isotope had already been inferred from the presence of a weak resonance in natural Ta.

The first millisecond half-lives have been observed: $\sim 15^{ms}$ Nb^{90} and 5.5^{ms} W^{180}.

The spin of Bi^{210} (RaE) has been found to be 1 and the beta spectrum fitted by S,T interaction with $\Delta J=1$, yes.

A low lying 1^- state has been found in a number of heavy even-even nuclei, e.g., Ra^{222}.

Element 101, Mendelevium (Mv), was produced.

The names Einsteinium (E) and Fermium (Fm) were proposed for elements 99 and 100 respectively.[8]

One of the outstanding nuclear data events of the year was, of course, the Geneva meeting. Previously unpublished results on neutron cross sections and resonances of the heavy nuclei (target nuclei U^{233}, U^{235}, Pu^{239}, Pu^{240}, etc.) were given in papers read there by delegates from the United Kingdom, France, the USSR, and the USA. These results, as reported in the preprints, are given here. They will be checked during 1956 with the official proceedings.

A surprising feature of the resonance data is the similarity of the values of the neutron energy, E_0, for the two lowest resonances in the compound nuclei U^{236}, Pu^{240}, Pu^{242}. A similarity in the resonance values of the K and Cl isotopes has been noted by the Duke group.[9]

There turned out to be satisfactory agreement among the neutron cross sections as measured in laboratories quite isolated from each other. The values reported and the adopted "world averages" based on these are given in Table 3 on Neutron Cross Sections.

The alpha, beta, and gamma transition probabilities of strongly deformed nuclei have been interpreted by the Danish group[10] through the introduction of the new collective model quantum numbers Ω and K.

The results obtained by means of the Coulomb excitation process are reported for about 94 nuclei in this cumulation. The predictions of the collective model with respect to level spacings, spin sequences, and the over-all variation of transition probability with mass number have been verified in the great majority of these cases (most of the rare earths, Th, U, etc.).

The accumulation of information on nuclear properties is leading to new attempts at systematization. Outstanding among these in 1955 was the survey of excited states of even-even nuclei by G. Scharff-Goldhaber and J. Weneser.[11] These authors showed that a dramatic change in nuclear structure takes place between configurations containing 88 and 90 nucleons. A theoretical study of the energy of nuclear levels in deformed nuclei by B. R. Mottelson and S. G. Nilsson[12] ascribes this to the breakup of the completed $h_{11/2}$ subshell.

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CONVENTIONS

All energies are given in Mev and all cross sections in barns unless otherwise stated in the tabular material.

Numerals in italics, following measured values, are the errors (as reported by the authors) in the last figure of the values. In cases where confusion seems possible, the conventional ± is used.

Magnetic moments are reported as before without diamagnetic correction. They are based on μ(H) = 2.79267 and the substandards listed by H. Walchli, ORNL-1469.

In writing reactions, the upper right hand superscript denoting A, the mass number of the target nucleus, is given without parentheses when the target was monoisotopic or when enriched (or depleted) material was used to establish the identity of the reacting isotope. It is given in parentheses when natural material was used and when the identity of the reacting isotope was strongly suggested by its predominating abundance, the observed reaction energy, or the activity or yield of the end product. It is given in parentheses with a question mark when the target A was assigned by systematics, elimination, etc. For instance, "B^{10}(d,p)" means that the proton groups from the deuteron bombardment of B^{10} were identified by comparing effects in B^{10} enriched and natural B samples. "B^{11}(d,p)" means that the assignment to B^{11} was made by using B^{11} depleted and natural B samples. "$C^{(12)}$(d,p)" means that natural C was used to study the reaction, but, because of the 99% abundance of C^{12}, the reaction observed was assumed to take place in that isotope. In the reaction "$Sn^{(116)}$(n,p)13^{s}In," the Sn isotope was identified by the In product. "$Te^{(125?)}$(d,p)$Te^{(126?)}$" indicates that from the trend of Q values in the region, the experimenters believed that their measured Q most likely belonged to the indicated reaction.

When a method of production of a radioactive nucleus is given, the lowest bombarding energy used by the experimenter is indicated; e.g., Ag(20-Mev p).

The large black dots on the decay schemes are used to indicate experimentally established coincidences. α, β, or γ rays entering a level and dotted at their arrowheads have been shown to be in coincidence with gamma rays leaving the same level and dotted at their origins. In case of a simple cascade, the dots of the incoming and outgoing rays are superimposed. Dashes are used for doubtful radiations or levels.

For the light nuclei, energy levels in the compound nucleus are usually tabulated rather than the resonant energy of the bombarding particle. The binding energy of the bombarding particle in the compound nucleus is taken from the table of F. Ajzenberg, T. Lauritsen, Revs. Modern Phys. 27, 77(1955) for Z < 11 and from P. M. Endt, J. C. Kluyver, Revs. Modern Phys. 26, 95(1954) for Z from 11 to 20.

ABBREVIATIONS

a	absorption
a $\beta\gamma$	absorption of β's in coincidence with γ's
a ce	absorption of conversion electrons
a coin	absorption of photoelectrons between counters in coincidence
act	neutron detection by activation (Mn, Rh, Ag, ...)
α	total γ-ray conversion coefficient, N_e/N_γ
$\alpha_K, \alpha_L, \ldots$	γ-ray conversion coefficient for electrons ejected from the K, L, ... shell
$\alpha_0, \alpha_1, \ldots$	α to g.s., first excited state, ... of residual nucleus
B	band spectra method
B(E2)	reduced E2 excitation probability in $barns^2$ (upward transition)
BF_3	boron trifluoride neutron counter
Be(γ,n)	measurement by detection of photoneutrons from Be
B_n, B_p	neutron, proton binding energy, i.e., energy necessary to remove particle from nucleus
$\beta\gamma\ (\llcorner)$	polarization-direction correlation of β's and γ's in coincidence
$\beta\gamma(\theta)$	angular correlation of β's and γ's in coincidence
calc	calculated from experimental work reported elsewhere
cc	cloud chamber
CcW	Cockcroft Walton accelerator
ce	conversion electrons
chem	chemical separation of product following reaction
Cp	Compton
crit a	critical absorption
cryst	crystal spectrometer
cyc	cyclotron
d	(1) deuteron, (2) descendant of, (3) days, when used as superscript
D	double resonance method
d,p(θ)	angular distribution of protons with respect to deuteron beam
D(γ,n),D(γ,p)	measurement by detection of photoneutrons or photoprotons from deuterium

$\bar{E}$	average energy
E_0	resonance energy
$E_\beta, E_\gamma, \ldots$	energy of β ray, energy of γ ray, . . .
E_{dis}	disintegration energy
EA	electrostatic analyzer
E1,E2, . . .	electric dipole, electric quadrupole, . . .
E_ϵ	energy of the electron capture transition (end point of γ continuum + K binding energy)
e_A	Auger electron
e_{AK}, e_{AL}	KXY, LXY Auger electron
el	elastic scattering
ϵ	(1) electron capture, (2) fractional transition probability for decay process observed
ϵ_K, ϵ_L	electron capture from K, L shell
$\eta(\theta)$	$[W(\theta) - W(\pi/2)]/W(\pi/2)$, a measure of asymmetry in angular distributions, where $W(\theta)$ is the count at angle θ
f	fission
F-K	Fermi-Kurie plot
ft	comparative half-life in the Fermi theory of β decay calculated for an allowed transition. Superscript 1, 2, or 3 on *f* indicates that comparative half-life is calculated for a unique 1st, 2nd, or 3rd forbidden transition.
g	(1) gyromagnetic ratio (2) statistical weight factor, $\frac{1}{2}[1 \pm 1/(2J+1)]$, in $g\Gamma_n$
Γ	resonance half-width (the whole width at half-maximum)
Γ_γ, Γ_n	partial resonance half-width for γ, neutron emission
$\gamma^\pm$	annihilation radiation
γ continuum	continuous γ spectrum associated with electron capture
$\gamma(Hg^{198})$	γ is emitted from nucleus in parentheses rather than from radioactive parent
$\gamma(\theta, T)$	numbers of γ's as function of angle and temperature
$\gamma\gamma$, $\beta\gamma$, $\alpha\gamma$, $n\gamma$	$\gamma\gamma$, $\beta\gamma$, $\alpha\gamma$, or $n\gamma$ coincidences. (0.123 γ) (0.246 γ, 0.325 γ) means 0.123 γ in coincidence with 0.246 γ and 0.325 γ
$\gamma\gamma(\theta)$	angular correlation of γ's in coincidence

$\gamma\gamma(t_{\leftarrow})$	polarization-direction correlation of γ's in coincidence
GM	Geiger-Müller counter
g.s.	ground state
h	hours
I	nuclear induction method
IB	internal bremsstrahlung
ic	ionization chamber
IT	isomeric transition
J	spin in units $h/2\pi$
L_1L_2/L_3	$(\alpha_{L_1} + \alpha_{L_2})/\alpha_{L_3}$
K/L, K/LM	α_K/α_L, $\alpha_K/(\alpha_L + \alpha_M)$
l	orbital angular momentum
Lin	linear accelerator
m	(1) medium intensity, (2) minutes, when used as a superscript
M	molecular or atomic beam resonance method
M1,M2, . . .	magnetic dipole, magnetic quadrupole, . . .
mb	millibarns
Mev	million electron volts (10^6 ev)
mev	millielectron volts (10^{-3} ev)
Mic	microwave method
mir	measurement by total reflection of neutron beam from mirror surface
mod cyc	modulated cyclotron
ms	mass spectrometer
μ	(1) magnetic moment in units of nuclear magnetons, (2) micron, 10^{-4} cm
μ_3	magnetic octopole moment in units of nuclear magneton barns
μs	microseconds
ν	neutrino
osc	pile oscillator method
p	(1) proton, (2) predecessor of
pr	electron-positron pair
p res	proton resonance. Magnetic field standardized by means of proton resonance frequency
para	paramagnetic resonance method
parentheses	parentheses are put around values which are given for identification purposes
pc	proportional counter
pe	photoelectrons
ppl	photoplates or emulsions
primes	primes indicate inelastically scattered particles
q	electric quadrupole moment in units of barns
quad res	quadrupole resonance method

q_4	nuclear electric 16-pole moment in units of 10^{-48} cm^4
Q	reaction energy in Mev
s	(1) spectrometer method, (2) seconds, when used as superscript
s coh	coherent scattering
S	atomic spectra measurement
scin	1-crystal scintillation counter
scin Cp	2-crystal scintillation counter
scin pr	3-crystal scintillation counter
sd	double focusing spectrometer
sl	lens spectrometer
sl ce	conversion electrons measured in lens spectrometer
st	strong
$s\pi$	180° spectrometer
$s\pi$ pr	180° pair spectrometer
σ	cross section in barns
σ_0	cross section at resonance energy, E_0
σ_a	absorption cross section
σ_t	total cross section
Σscin	scintillation counter used to sum energy of transitions in cascade
Σpc	proportional counter used to sum energy of transitions in cascade
t	(1) triton, H^3, (2) total cross section when used under σ in cross section list
trans	transmission
T	(1) isotopic spin; (2) temperature
τ	half life in units indicated
τ_1, τ_2	half life of upper, lower state
$\tau_{\beta\beta}, \tau_{\epsilon\epsilon}$	half life for double β, double ϵ decay
th	thermal
VdG	Van de Graaff accelerator
w, vw	weak, very weak
x	x radiation
y	years
$Y_\gamma, Y_p, \ldots$	yield of γ rays, yield of protons, . . .
%	% of disintegrations
†	relative numbers. When used in connection with γ rays, relative numbers of photons, not photons plus conversion electrons, are meant
+, −	even, odd parity when used in connection with level properties

Standard journal abbreviations are used.

JOURNALS ABSTRACTED FOR NSA VOLUME 9

Numbers following a colon are issue numbers, other numbers (except years) are volume numbers. All numbers are inclusive.

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For information on reports and occasional papers in journals other than the above, Nuclear Science Abstracts, Chemical Abstracts, and Physics Abstracts are surveyed.

1. RADIOACTIVITY, LEVELS, ABUNDANCES, MOMENTS

Unassigned activities from proton bombardment

τ (sec)	Target	E_p
0.4	Mg	50
4.5	Mg	80
~0.2	Al^{27}	80
~2.5	Si	20
~1	Si	50
0.2	Ti	80
0.77	Mn^{55}	95
0.55	Fe	50
0.3	Cu	130
1.3	Cu	130
0.15	Zn	100
0.8	Zn	100

H.Tyrén, P.A.Tove, Phys. Rev. 96,773(1954).

ν

μ $< 10^{-7}$
From counting rate in large liquid scintillator near reactor

C.L.Cowan, Jr., F.Reines, F.B.Harrison, Phys. Rev. 96, 1294 (1954).

$\sigma[Cl^{37}(\nu, e^-)A^{37}] < 2\times10^{-18}$b for fission ν

R.Davis,Jr., Phys. Rev. 97, 766; 99, 664 (1955).

n^1
0 1
12^m

τ 12^m *1.5* pile n
$p\beta$ measured at 144°, 162°, 176° pc;GM

Geneva Conf. 8/P/650 (1955), P.E.Spivac, et al. (USSR). See Appendix.

J 1/2 M
Direct measurement with neutron beam

C.P.Stanford, T.E.Stephenson, S.Bernstein, Phys. Rev. 96, 983 (1954).

H^1
1 0
stable

τ $> 10^{21}$y
From pulse rate in large scintillator of C_7H_8 with 100 ft of rock shielding
τ for bound $p > 10^{22}$ y

F.Reines, C.L.Cowan, Jr., M.Goldhaber, Phys. Rev. 96, 1157 (1954).

H^1
1 0
stable

μ +2.79281 *4*
Used Jeffries type decelerating cyclotron

D.J.Collington, A.N.Dellis, J.H.Sanders, K.C.Turberfield, Phys. Rev. 99, 1622 (1955).

g +2.67562 *16* $\times10^4$ sec^{-1} $gauss^{-1}$
Magnetic field calculated from dimensions of and current in iron free coil
Suggest difference from 2.67523 *6** is due to ampere conversion factor

F.Kirchner, W.Wilhelmy, Z. Naturf. 10a, 657 (1955); *H.A.Thomas et al., Phys. Rev. 78, 787 (1950).

H^3
1 2
12.4^y

$H^2(n,n)$ $E_n = 0.100, 0.146, 0.200$ pc
$n,n(\theta)$ strongly anisotropic

W.D.Allen, A.T.G.Ferguson, J.Roberts, Proc. Phys. Soc. 68A, 650 (1955).

He^3
2 1
stable

Level $H^2(d,n)$ $E_d = 0.085$ ppl
g.s. $Q = 3.276$ *24*

S.Subotić, B.Maglić, Phil. Mag. 46, 805 (1955).

Capture γ $H^2(p,\gamma)$ $E_p = 0.5$ to 1.85
~6 $Q = 5.50$ 3 scin
$p,\gamma(\theta) \simeq b + \sin^2\theta$; b(small) shows max at $E_p = 1$
$\int\sigma d\omega = 4 \pm 2\ \mu b$ for $E_p = 1$

G.M.Griffiths, J.B.Warren, Proc. Phys. Soc. 68A, 781 (1955).

$H^2(p,p)$ $E_p = 20.6$
$p,p(\theta)$ shows small dip at 18° due to Coulomb-nuclear interference, large dip at ~130°

D.O.Caldwell, J.R.Richardson, Phys. Rev. 98, 28 (1955).

He^4
2 2
stable

$H^2(d,n)$ $E_d = 0.10$ ppl
$d,n(\theta)$ for $0° < \theta < 150°$ $\eta(\pi) = 0.48 \pm 0.09$

J.C.Fuller, D.C.Ralph, Phys. Rev. 98, 248A (1955).

He^4
2 2
stable

$H^2(d,p)$ $E_d = 0.15$ to 0.45
$H^2(d,n)$ H^3, He^3 detected, pc
$\sigma(H^3)/\sigma(He^3) < 1$ Ratio decreases with E_d
d,n(θ) more asymmetric than d,p(θ)

G.Preston, P.F.D.Shaw, S.A.Young, Proc. Roy. Soc. 226A, 206 (1954).

$H^2(d,p)$ $E_d = 0.014$ to 0.466
$H^2(d,n)$
$\sigma(H^3)/\sigma(He^3) = 0.99$ to 0.83 for above E_d
$\sigma(H^3) = \sigma(He^3)$ at 90° c.m. for all E_d
From recalculation of old results* using
angular distribution of Preston above

K.G.McNeill, Phil. Mag. 46, 800 (1955); *K.G. McNeill, G.M.Keyser, Phys. Rev. 81, 602 (1951); *W.R.Arnold et al., Phys. Rev. 93, 483, (1955).

$H^2(d,p)$ $E_d = 190$
$H^2(d,n)$ H^3, He^3 detected
$\sigma(H^3)/\sigma(He^3) = 0.86 \pm 0.14$ at 30° c.m.

C.S.Godfrey, Phys. Rev. 96, 1621 (1954).

No level $H^3(p,\gamma)$ $E_p = 0.1$ to 6.2; scin
No cascade γ's ($<$ 15% of g.s. γ if $\Delta E_\gamma = 2$)
$p,\gamma(\theta) = (\sin\theta + a\cos\theta)^2$; a increases with E_p
$\sigma(E_p = 1, 90°) = 3.65\ \mu b$/sterad

J.E.Perry, Jr., S.J.Bame, Jr., Phys. Rev. 99, 1368 (1955).

$He^4(\gamma,p)$ $E_\gamma \lesssim 20$ to $\lesssim 40$
σ curve shows max ($\sim$1.8 mb) at $E_\gamma \sim 26$
$\int\sigma\, dE = 0.016$ Mev barns
$\gamma,p(\theta)$ has $\cos\theta$ term ppl

E.G.Fuller, Phys. Rev. 96, 1306 (1954); Phys. Rev. 83, 202A (1951).

He^5
2 3
$\sim 10^{-21}$s

Level $Li^{(6)}(d,He^3)$ $E_d = 14.4$ s
2.1* g.s. $Q = 0.91$ *9*
$Li^{(7)}(d,\alpha)$ s
32* g.s. $Q = 14.26$ *9*
*mb/sterad at 12.3°, 11.2° c.m. resp.

S.H.Levine, R.S.Bender, J.N.McGruer, Phys. Rev. 97, 1249 (1955).

Levels $Li^6(t,\alpha)$ $E_t = 0.24$
g.s. s, pc
other ?

K.W.Allen, E.Almqvist, J.T.Dewan, T.P.Pepper, Phys. Rev. 96, 684 (1954).

$H^2(t,\alpha)$ $E_t = 1.5$ pc
$\int d\sigma = 0.280$ *8* t,$\alpha(\theta)$

A.Hemmendinger, H.V.Argo, Phys. Rev. 98, 70 (1955).

He^5
2 3
$\sim 10^{-21}$s

$H^3(d,\gamma)$ $E_d = 0.16$
$\sigma < 0.5$ mb scin

G.A.Sawyer, L.C.Burkhardt, Phys. Rev. 98, 1305 (1955).

Levels $He^{(4)}(n,n)$ $E_n = 14.3$ cc
n,$\alpha(\theta)$ results for $\theta = 20°$ to 90° agree with
Dodder, Gammel curve

D.F.Shaw, Proc. Phys. Soc. 68A, 43 (1955).

He^6
2 4
0.83^s

τ 0.799^s *3* $Li^{(7)}(\lesssim 65$-Mev $\gamma,p)$

R.M.Kline, D.J.Zaffarano, Phys. Rev. 96, 1620 (1954).

τ 0.85^s *3* Be^9(pile n,α) chem
$\beta, Li^6(\theta)$ gives $-0.5 < G_A/G_T < +0.3, \therefore G_A \sim 0$

B.M.Rustad, S.L.Ruby, Phys. Rev. 97, 991 (1955).

Levels $Li^{(7)}(d,He^3)$ $E_d = 14.4$ s
8* g.s. $l_p = 1$ d,$He^3(\theta)$
2* (1.71) $l_p = 1$
*mb/sterad at 17°, 16.5° c.m. resp.

S.H.Levine, R.S.Bender, J.N.McGruer, Phys. Rev. 97, 1249 (1955); 95, 640A (1954).

Levels $Li^{(7)}(t,\alpha)$ $E_t = 0.24$
1† g.s. $J = 0^+$ t,$\alpha(\theta)$
8† (1.71) $J = 2^+$

E.Almqvist, T.P.Pepper, P.Lorrain, Can. J. Phys 32, 621 (1954).

Levels $Li^7(t,\alpha)$ $E_t = 0.24$ pc
g.s $Q = 9.79 \pm 0.03$
1.71 *1* $\Gamma < 0.1$?
3.35* ?
*From α's observed at backward angles only

K.W.Allen, E.Almqvist, J.T.Dewan, T.P.Pepper, Phys. Rev. 96, 684 (1954).

Levels $Li^7(t,\alpha)$ $E_t = 0.9$
1.71 $\Gamma < 0.1$
3.4 ? $\Gamma < 0.3$

K.W.Allen, E.Almqvist, C.B.Bigham, Phys. Rev. 99, 631A (1955).

Levels $Li^{(7)}(t,\alpha)$ $E_t < 3.8$ ppl
$\sigma \leq 0.01$ 1.6 *6* $Q = 8.2$ One event
$\sigma \leq 0.01$ 4.2 *5* $Q = 5.6$ One event

P.Cüer, D.Magnac-Valette, G.Baumann, Compt. rend. 240, 1880 (1955).

Li
3

Abundances
Li^6 8.0% $\mathrm{Li}^7/\mathrm{Li}^6 = 11.53 \pm 0.29$
Li^7 92.0%
From crystal density and x ray data

D.A.Hutchison, Phys. Rev. 96, 1018 (1954).

Li^6 7.42% $\mathrm{Li}^7/\mathrm{Li}^6 = 12.48 \pm 0.04$
Li^7 92.58%

M.J.Higatsberger, Acta Phys. Austriaca, 9, 179 (1955).

Li^6 7.29 to 7.42% 18 different
Li^7 92.71 to 92.58% sources

A.E.Cameron, J. Am. Chem. Soc. 77, 2731 (1955).

Li^4?
3 1

τ $\sim 0.4^{s}$ Li(50-Mev p)
See also Be^6 Be^9(50-Mev p)

H.Tyrén, P.A.Tove, Phys. Rev. 96, 773(1954).

Li^4
3 1

$\mathrm{H}(\mathrm{He}^3,\mathrm{He}^3)$ $E_{\mathrm{He}^3} = 14.9$ ppl
He^3, $\mathrm{He}^3(\theta)$ shows minimum near 90°c.m.

D.R.Sweetman, Phil. Mag. 46, 358 (1955).

Li^5
3 2

Level $\mathrm{Li}^6(p,d)$ $E_p = 18.6$ pc,scin
g.s. $Q = -3.0\ 2$ $\Gamma \sim 1.8$
$l_n = 1$ $p,d(\theta)$
g.s. group asymmetric on low energy side. No other level found up to 6.5

J.G.Likely, Phys. Rev.98, 1538A (1955).

$\mathrm{Li}^6(\mathrm{He}^3,\alpha)$ $E_{\mathrm{He}^3} = 0.9$ pc
α groups observed with $E_\alpha = 7.5,\ 8.3$

E.Almqvist, K.W.Allen, C.B.Bigham, Phys. Rev. 99, 631A (1955).

$\mathrm{He}^4(p,p)$ $E_p = 9.76$ ppl
$p,p(\theta)$ results agree with Putnam's

J.H.Williams, S.W.Rasmussen, Phys. Rev. 98, 56, 1167A (1955).

$\mathrm{He}^4(p,p)$ $E_p = 9.73$ scin
Graph of $p,p(\theta)$ disagrees with Putnam's

B.Cork, W.Hartsough, Phys. Rev. 96,1267(1954).

Li^5
3 2

Level $\mathrm{H}^2(\mathrm{He}^3,p)$ $E_{\mathrm{He}^3} = 0.1$ to 0.8
16.8 3 pc,scin
$\mathrm{He}^3,p(\theta)$ isotropic for $E_{\mathrm{He}^3} = 0.20, 0.29, 0.35$
$\sigma_{\mathrm{max}} = 0.70$ for $E_{\mathrm{He}^3} = 0.640$
Resonance in this and $\mathrm{H}^2(\mathrm{H}^3,p)$ reaction can be fitted with ~same parameters if $J = 3/2+$ is assumed for compound states

W.E.Kunz, Phys. Rev. 97, 456 (1955).

Level $\mathrm{He}^3(d,\gamma)$ $E_d = 0.2$ to 2.85
γ 16.6 2 $\Gamma_\gamma = 11$ ev
$E_0 = 0.45\ 4$ $\sigma_0 = 0.05$ mb
$d,\gamma(\theta) \sim$ isotropic at $E_d = 0.58$

J.M.Blair, N.M.Hintz, D.M.Van Patter, Phys. Rev. 96, 1023 (1954).

Li^6
3 3
stable

μ +0.821921 I
$\nu(\mathrm{Li}^6)/\nu(\mathrm{H}^2) = 0.958638\ 38$

H.E.Walchli, ORNL-1775 (1954).

Level $\mathrm{Li}^6(p,d)$ $E_p = 18.6$ pc,scin
g.s. $l_n = 1$ $p,d(\theta)$

J.G.Likely, Phys. Rev. 98, 1538A (1955).

Levels $\mathrm{Li}^{(7)}(d,t)$ $E_d = 14.4$ s
32.4* g.s. $l_n = 1$ $d,t(\theta)$
16.0* (2.19) $l_n = 1$
*mb/sterad at 11°, 16° c.m. resp.

S.H.Levine, R.S.Bender, J.N.McGruer, Phys. Rev. 97, 1249 (1955); 95, 640A (1954).

Levels $\mathrm{He}^4(d,d)$ $E_d = 0.3$ to 4.6 EA

Level	Γ	J
2.187	0.035	3^+
(3.58)	No scattering anomaly	
4.53*		2^+
5.4 *		1^+

*From phase shift analysis of broad anomaly from $E_d = 3$ to 4.62. This analysis suggests odd additional levels above 5 Mev.

A.Galonsky, R.A.Douglas, W.Haeberli, M.T. McEllistrem, H.T.Richards, Phys. Rev. 98, 586, 590 (1955); 96, 824A; 93, 928A (1954).

Levels $\mathrm{Li}^7(\mathrm{He}^3,\alpha)$ $E_{\mathrm{He}^3} = 0.9$

Level	Γ	Level	Γ
2.19	<0.1	6.63 8	<0.2
3.56 6*	<0.1	7.40 10	0.6
4.3 2	?	8.37 8 ?	<0.2
5.35 7	<0.1	9.3 2 ?	0.6
5.6 2 ?	2.0		

*Recoil Li^6 ions show this level emits γ's

K.W.Allen, E.Almqvist, C.B.Bigham, Phys. Rev. 99, 631A (1955).

$^{7}_{3}\mathrm{Li}_{4}$
stable

μ +3.256003 I
$\nu(\mathrm{Li}^{7})/\nu(\mathrm{Na}^{23}) = 1.469225$ *3*

H.E.Walchli, ORNL-1775 (1954).

Level $\mathrm{Li}^{(7)}(d,t)\mathrm{Li}^{6}$ g.s. and 2.19 level
g.s $l_n = 1$ See Li^{6}
$\mathrm{Li}^{(7)}(d,\mathrm{He}^{3})\mathrm{He}^{6}$ g.s. and 1.71 level
g.s $l_p = 1$ See He^{6}

S.H.Levine, R.S.Bender, J.N.McGruer, Phys. Rev. 97, 1249 (1955).

Level $\mathrm{Li}^{(7)}(\alpha,\alpha'\gamma)$ $E_\alpha = 1.9$ scin
(0.478)
$\tau < 3\mathrm{x}10^{-13\mathrm{s}}$ from Doppler shift of γ
$\alpha\gamma(\theta)$ isotropic within 10%

C.W.Li, R.Sherr, Phys. Rev. 96, 389 (1954).

Level $\mathrm{Li}^{(7)}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.30$ sl
0.478 *2*
$\tau < 1.3\mathrm{x}10^{-13\mathrm{s}}$ from Doppler shift of γ

V.S.Zhpinel, Izvest. Akad. Nauk Ser. Fiz. SSSR 18, 65 (1955).

Level $\mathrm{Li}^{(7)}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.3$ scin
0.483
No other γ observed

R.J.Breen, M.R.Hertz, Phys. Rev. 98, 599 (1955).

Levels $\mathrm{Li}^{(6)}(d,p)$ $E_d = 14.4$ s
12.8* g.s. $l_n = 1$ d,p(θ)
9.2* (0.478) $l_n = 1$
< 3* (4.61) not observed
32.0* 6.56 Q = 0.91
*mb/sterad at 18°, 17.5°, < 20°, 12.3° c.m. resp.

$\mathrm{Li}^{(7)}(d,d')$ $E_d = 14.4$ s
g.s.
7.7* (0.478) $l_d = 2$ d,d'(θ)
8.8* 4.62 *4* $l_d = ?$
*mb/sterad at 32°, 47° c.m. resp.

S.H.Levine, R.S.Bender, J.N.McGruer, Phys. Rev. 97, 1249 (1955); 95, 640A (1954).

Levels $\mathrm{Li}^{(7)}(\gamma,\alpha)$ $E_\gamma \leq 31$ ppl
4.7 *1* J = 5/2 $\gamma,\alpha(\theta)$
5.5 *1* J = 5/2 (3/2, 1/2 ?)
6.8 *1* J = 5/2 (3/2, 1/2 ?)
Possible levels at 7.4, 8.3, 9.0
$\sigma(E_\gamma = 4.7) \sim 0.15$ mb

P.Stoll, Helv. Phys. Acta 27, 395 (1954).
P.Erdös, P.Stoll, M.Wächter, V.Wataghin, Nuovo Cim. 12, 639 (1954).

$^{7}_{3}\mathrm{Li}_{4}$
stable

Levels $\mathrm{Be}^{9}(d,\alpha)\mathrm{Li}^{7} \rightarrow \alpha + t$ $E_d = 1.25$
4.6 ppl 30°
6.6 Magnetic field
No 5.5 level found for t separation

P.Cüer, J.Jung, J. phys. radium 16, 385 (1955).

Level $\mathrm{Li}^{6}(n)$ $E_n = 0.035$ to 4.2
7.46 $E_0 = 0.26$ *1* $\sigma_0 = 10.3$
J = 5/2− $\Gamma_\alpha = 0.06$, $\Gamma_n = 0.114$

C.H.Johnson, H.B.Willard, J.K.Bair, Phys. Rev. 96, 985 (1954).

n, t(θ) $\mathrm{Li}^{6}(n,t)$ $E_n = 1.1, 1.5, 2.0$
ppl

J.B.Weddell, J.H.Roberts, Phys. Rev. 95, 117 (1954).

Levels $\mathrm{Li}^{(7)}(\gamma,t)$ $E_\gamma \leq 21$ ppl
7.6 11.7
8.6 13.5 ?
st 9.6 st 16.2

M.Miwa, J. Phys. Soc. Japan 10, 173 (1955).

Resonance peaks $\mathrm{Li}^{(7)}(\gamma,p)$ $E_\gamma \leq 31$
15.5 $0.83^{\mathrm{s}}\mathrm{He}^{6}$
20.3
23 ?

R.Rubin, M.Walter, Helv. Phys. Acta 27, 163 (1954).

Resonance peaks $\mathrm{Li}^{(7)}(\gamma,n)$ $E_\gamma \leq 31$
15.5 BF_3
21
29 Due to γ, 2n ?

F.Heinrich, R.Rubin, Helv. Phys. Acta 28, 185 (1955).

$^{8}_{3}\mathrm{Li}_{5}$
0.84^{s}

τ 0.841^{s} *4* $\mathrm{Be}^{9}(\leq 65\text{-Mev } \gamma,p)$

R.M.Kline, D.J.Zaffarano, Phys. Rev. 96, 1620 (1954).

Levels $\mathrm{Li}^{(7)}(d,p)$ $E_d = 14.4$ s
26.1* g.s. $l_n = 1$ d,p(θ)
10.2* 0.974 *15* $l_n = 1$ Q = −1.162
*mb/sterad at 8°, 2° c.m. resp.

S.H.Levine, R.S.Bender, J.N.McGruer, Phys. Rev. 97, 1249 (1955); 95, 640A (1954).

Li^8
3 5
0.84^s

Level $Li^{(6)}(t,p)$ $E_t < 3.8$ ppl
0.7 *2* $Q = 0.10$ One event

P.Cüer, D.Magnac-Valette, G.Baumann, Compt. rend. 240, 1880 (1955).

Level $Li^{(7)}(n,n' + 0.478\gamma)$ $E_n = 0.4$ to 1.7
3.22 $\Gamma = 1.14$ scin
$\sigma(E_n)$ fitted assuming either $J = 1+$ or $1-$

J.M.Freeman, A.M.Lane, B.Rose, Phil. Mag. 46, 17 (1955).

Li^9
3 6
0.17^s

$U^{235}(\gamma, f)$ $E_\gamma \leq 11$
$8 \pm 2 \times 10^{-5}$ delayed n's per fission with
$\tau = 0.15 \pm 0.04^s$ tentatively assigned here

P.J.Bendt, F.R.Scott, Phys. Rev. 97, 744(1955).

Be^6?
4 2

τ $\sim 0.4^s$ Li(50-Mev p)
See also Li^4 Be(50-Mev p)

H.Tyrén, P. A.Tove, Phys. Rev. 96, 773(1954).

Be^7
4 3
53.6^d

Level $Be^7(n,\alpha)$ $\sigma(E_n = th) < 1$ ic
$Be^7(n,p)$ $\sigma(E_n = th) = 5.3 \times 10^4$
g.s.   Parity odd from σ's

R.C.Hanna, Phil. Mag. 46, 381 (1955).

Levels $Li^{(7)}(p,n)$ $E_p = 2.5$ to 2.9
100+   g.s. $He^3(n,p)$ detector
3+ to 8+   (0.43)   at forward angles
σ(0.43 level)/σ(g.s.) increases with E_p

R.Batchelor, Proc. Phys. Soc. 68A, 452 (1955).

Levels $Li^{(6)}(d,n)$ $E_d = 0.930$
g.s.   ppl 0°, 120°
0.49 *5*
2.28 *5*

J.Catalá, J.Aguilar, F.Senent, Anales real soc. españ. fís. y quím. 51A, 173 (1955).

Levels $B^{10}(p,\alpha)$ $E_p = 18$; 60°, 90°, 120°
g.s. $Q = 1.07$ *10*   ic
0.49 *10*
4.72 *8*
6.27 *10*
7.21 *10*
14.6 *3*

J.B.Reynolds, Phys. Rev. 98, 1289 (1955); 95, 639A (1954).

Be^7
4 3
53.6^d

Capture γ's $Li^6(p,\gamma)$ $E_p = 0.300$
35+   0.43 *2*   scin
35+   5.40 *15*
65+   5.90 *15*
+Photons/100 Li^6 captures
σ for cascade $= 0.7\ \mu b$ at $E_p = 0.415$

Level   (6.35) $E_p = 0.18$ to 0.415
0.43 γ yield as $f(E_p)$ gives $(2J+1)\Gamma_\gamma = 1.0$ *3* ev
for cascade transition from this level

S.Bashkin, R.R.Carlson, Phys. Rev. 97, 1245; 98, 230A (1955).

Be^8
4 4

Level, Q $B^{10}(n,t)$ $E_n = 4.87$ BF_3, pc
g.s. $Q = +0.35$ *20*
Reaction observed was possibly $B^{10}(n,p)Be^{10}$

D.B.James, W.Kubelka, S.A.Heiberg, J.B.Warren Can. J. Phys. 33, 219 (1955); Phys. Rev. 96, 856A (1954).

Be^8
4 4
$\sim 10^{-16}s$

Level $Be^9(d,t)$ $E_d = 0.58$ to 1.40
g.s. $d, t(\theta)$ See Be^9

M.K.Jurić, Phys. Rev. 98, 85 (1955); Bull. Inst. Nuclear Sci., Boris Kidrich 5, 7 (1955); 3, 139 (1953).

Level $B^{(11)}(p,\alpha_0)2\alpha$ $E_p = 0.163$
g.s.   Q(break-up) = 0.090 *5*
$\alpha_0, \alpha(\theta)$ $\tau < 4 \times 10^{-15s}$ $J = 0$

P.B.Treacy, Proc. Phys. Soc. 68A, 204(1955).

Levels $Be^9(d,t)$ $E_d = 1.25$ ppl 30°
g.s.   Magnetic field
2.8   for t separation
No other level with energy < 2.8

P.Cüer, J.Jung, J. phys. radium 16, 385(1955).

Levels $B^{(11)}(p,\alpha)$ $E_p = 2.61$ 10°, 90°
$B^{10}(d,\alpha)$
$E_d = 1.43$ ~0°
$E_d = 2.09$ 108°
$E_d = 2.39$ 60°, 90°, 108°
$E_d = 3.18$ 60°, 108°
g.s.   s
2.94
No other level with energy < 8
Several thousand counts for each E, $\Delta E \sim 0.1$

R.E.Holland, D.R.Inglis, R.E.Malm, F.P.Mooring, Phys. Rev. 99, 92; 98, 240A (1955).

Level $B^{(11)}(p,\alpha_1)2\alpha$ $E_p = 0.163$
(2.9) $J = 2$ $\alpha_1, \alpha(\theta)$

E.H.Geer, E.B.Nelson, E.J.Wolicki, Phys. Rev. 98, 241A (1955).

Be^{8}
4 4
$\sim 10^{-16}$s

Level $He^{4}(\alpha,\alpha)$ $E_{\alpha} = 3$ to 6; 3 angles
2.9 $\Gamma = 0.8$ $J = 2^{+}$

G.C.Phillips, J.L.Russell, C.W.Reich, Phys. Rev. 100, 960A (1955).

Level $Li^{(7)}(d,p)Li^{8} \xrightarrow{\beta} Be^{8} \longrightarrow 2\alpha$
2.9
Spectrum of delayed α's shows no transition to any other Be^{8} level below 13 Mev

R.T.Frost, S.S.Hanna, Phys. Rev. 99, 8 (1955).

Levels $C^{(12)}(n,n'\alpha)$ $E_{n} = 12$ to 20
g.s. ppl, 2000 stars
~3 See also C^{12}

G.M.Frye, Jr., L.Rosen, L.Stewart, Phys. Rev. 99, 1375 (1955).

Levels $C^{(12)}(p,p'\alpha)$ $E_{p} = 29$
25% g.s. cc, 200 stars
50% ~3 See also C^{12}
Higher levels ?
% of events

J.L.Need, Phys. Rev. 99, 1356 (1955); 98, 1538A (1955).

Levels $Li^{(7)}(d,n)$ $E_{d} = 2$ pc, scin
g.s. $l_{p} = 1$ d, n(θ)
~3 $l_{p} = 1$

C.C.Trail, C.H.Johnson, Phys. Rev. 98, 249A (1955).

Levels $Li^{(7)}(d,n)$ $E_{d} = 0.686$
g.s. ppl 90°, 115°, 145°
~3
5.4 ?
7.5

M.A.Ihsan, Phys. Rev. 98, 689 (1955); Proc. Phys. Soc. 68A, 393 (1955).

Levels $Li^{(7)}(d,n)$ $E_{d} = 0.88$
g.s. ppl 120°
2.1 ?
2.9 $\Gamma \sim 0.8$
4.1
5.3

W.M.Gibson, Phil. Mag. 46, 807 (1955).

Levels $Li^{(7)}(d,n)$ $E_{d} = 0.930$ ppl
11.19 *5* 12.39 *4* 0°,
11.96 *5* 14.38 *7* 120°

J.Catalá, J.Aguilar, F.Senent, Anales real soc. españ. fís. y quím. 51A, 173 (1955).

Be^{8}
4 4
$\sim 10^{-16}$s

Level $Li^{(7)}(p,n)$ $E_{p} = 1.88$ to 2.5
~18.89 $\Gamma =$ several 100 kev
Resonance just at p,n threshold

H.W.Newson, Phys. Rev. 100, 960A (1955).

Level $Li^{(7)}(p,n)$ $E_{p} > 1.88$
~18.89 $\Gamma \sim 0.03$ pc
$\sigma/E_{n}^{1/2}$ found to decrease as E_{n} increases

R.C.Hanna, Phil. Mag. 46, 381 (1955).

Level $Li^{(7)}(p,\gamma)$ $E_{p} = 1$ to 3.5
19.04 $\Gamma = 0.3$ scin 0°, 90°
16 Mev γ (and not 19 Mev γ) is resonant

R.M.Williamson, K.W.Jones, Phys. Rev. 100, 960A (1955).

Level $Li^{(7)}(p,\gamma)$ $E_{p} = 1.5$ to 5
19.1 $\Gamma = 0.4$ scin ($E_{\gamma} > 10$)

C.P.Swann, M.A.Rothman, W.C.Porter, C.E.Mandeville, Phys. Rev. 98, 1183A (1955).

Levels $Li^{(7)}(p,n)$
(19.2) $J = 3^{+}$, $T = 1$
Background due to $J = 1^{-}$ and $J = 2^{-}$, $T = 0$ states
Conclusions from analysis of available data

R.K.Adair, Phys. Rev. 96, 709 (1954).

$Li^{6}(d,t)$ $E_{d} = 0.4$ to 5.5
$\sigma(E_{d} \sim 1) = 0.19$, $\sigma(E_{d} \sim 4) = 0.29$

R.L.Macklin, H.E.Banta, Phys. Rev. 97, 753 (1955); 95, 302A (1954).

Be^{9}
4 5
stable

Level $Be^{9}(d,t)Be^{8}$g.s. ppl
g.s. d, t(θ) $E_{d} = 0.58$ to 1.40
d, t(θ) shows forward pick-up peak at all E_{d}
Peak is largest at $E_{d} = 1.28$ See Be^{10}, B^{11}

M.K.Jurić, Phys. Rev. 98, 85 (1955); Bull. Inst. Nuclear Sci., Boris Kidrich 5, 7 (1955'; 3, 139 (1953).

Levels $B^{(11)}(d,\alpha)$ $E_{d} = 1.51$
g.s. s 50°, 90°, 101°
1.75* *2*
2.43 *2*
3.02* *3*
4.41 ? ⎤ Believed to be ghosts
4.59 ? ⎦
*Low intensity (especially at 90°) and large natural width

L.L.Lee, Jr., D.R.Inglis, Phys. Rev. 99, 96 (1955).

Be^9
4 5
stable

Levels $Li^7(He^3,p)$ $E_{He^3} = 0.72$ scin
g.s.
1.8 *2*
2.4 *2*
3.2 *1*
4.9 *1*
p's distinguished from d's by absorption

C.D.Moak, W.M.Good, W.E.Kunz, Phys. Rev. 96, 1363; 95, 640A (1954).

Levels $Be^9(p,p')$ $E_p = 3$ to 6.5; a
g.s.
2.43 *5*
Graph of $d\sigma/d\omega\,(90^\circ)$ given

G.W.Greenlees, Proc. Phys. Soc. 68A, 97(1955)

Levels $Li^7(He^3,p)$ $E_{He^3} = 0.9$

Level	Γ	Level	Γ
1.81 *1*	<0.4	3.06 *8*	<0.3
2.39 *8*	<0.2	4.74 *8*	1.2
		9.2?	1.2

$B^{10}(t,\alpha)$ $E_t = 0.9$
2.39
3.06

E.Almqvist, K.W.Allen, C.B.Bigham, Phys. Rev. 99, 631A (1955).

$Be^9(n,?\gamma)$ $E_n = 3.2$ scin
No γ's observed

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Level? $Li^7(d,t)$ $E_d = 1.3$ to 5.5
~18.6?
$\sigma(E_d \sim 2.4) = 0.095$, $\sigma(E_d \sim 4) = 0.165$

R.L.Macklin, H.E.Banta, Phys. Rev. 97, 753 (1955).

Be^{10}
4 6
2.5×10^6y

Level $Be^9(d,p)$ $E_d = 0.62$ to 1.40
g.s. d,p(θ) ppl
Forward peak intensity ($l_n = 1$?) is greatest
for $E_d = 1.19, 1.40$. See Be^9, B^{11}

M.K.Jurić, Phys. Rev. 98, 85 (1955); Bull. Inst. Nuclear Sci., Boris Kidrich 5, 7 (1955); 3, 139 (1953).

Levels $Be^9(d,p)$ $E_d = 11.9$
g.s. $l_n = 1$ d,p(θ)
(3.37) $l_n = 1$

F.S.Eby, Phys. Rev. 96, 1355 (1954).

Be^{10}
4 6
2.5×10^6y

Levels $Be^9(d,p)$ $E_d = 5.4$ to 7.4
g.s. Q = 4.586 *9* sπ 90°
3.37 *1* st 6.26 *1*
5.96 *1* 7.37 Γ~0.025
w 6.18 *1* 7.54 Γ~0.010

J.J.Jung, C.K.Bockelman, Phys. Rev. 96, 1353 (1954); Phys. Rev. 94, 748A (1954).

Capture γ's $Be^9(\text{th }n,\gamma)$ sπ Cp
54+ 3.40 double
73+ 6.80
+Photons/100 Be captures

Geneva Conf. 8/P/651 (1955), L.V.Groshev et al. (USSR). See Appendix.

γ $Be^9(d,p\gamma)$ $E_d \leq 2.5$ sl pr
1.4* 6.03 *5* No Doppler correction
*Average σ in mb for $E_d = 0$ to 2.5
No γ with $6.5 < E_\gamma < 8.0$ for $E_d = 3.85$ (< 5% 6.0γ)

R.D.Bent, T.W.Bonner, J.H.McCrary, W.A. Ranken, R.F.Sippel, Phys. Rev. 99, 710 (1955).

Levels $Be^9(n)$ $E_n = 0.2$ to 1.50
$Be^9(n,n)$ $E_n = 0.54, 0.62, 0.70$

$\int d\sigma$*	σ_o	Level	E_o	J	l	Γ
7.5	7.8	(7.37)	(0.62)	3	1(2?)	0.025
	5.3	(7.54)	(0.81)	2		0.008

*From n,n(θ)

H.B.Willard, J.K.Bair, J.D.Kington, Phys. Rev. 98, 669 (1955).

Levels $Be^9(n,\alpha)$ $E_n = 3.3$ to 6.1
10.17 ? 0.83*He^6
10.65 ?

A.R.Sattar, I.L.Morgan, .Hudspeth, Phys. Rev. 100, 960A (1955).

Levels $Li^{(7)}(t,\alpha)$ $E_t = 0.24$
~17.4 J = 2+, 2− levels t,α(θ)

E.Almqvist, T.P.Pepper, P.Lorrain, Can. J. Phys. 32, 621 (1954).

B
5

γ $B(n,?\gamma)$ $E_n = 4.5$ scin
w 0.70 Not found for $E_n = 1.3$
2.20 *6*

G.L.Griffith, Phys. Rev. 98, 579 (1955).

γ $B(n,?\gamma)$ $E_n = 3.2$ scin
st 0.43 1.41
0.76 1.61
1.02 2.0
1.17

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

B^{9}
5 4

Levels $C^{(12)}(p,\alpha)$ $E_p = 18$; 60°, 90°, 120°
g.s. $Q = -7.58$ *10* 1c
2.39 *8*
No other level with energy < 7.9 observed

J.B.Reynolds, Phys. Rev. 98, 1289 (1955); 95, 639A (1954).

Level $B^{10}(He^3,\alpha)$ $E_{He^3} = 0.9$
2.58 *13*

E.Almqvist, K.W.Allen, C.B.Bigham, Phys. Rev. 99, 631A (1955).

Levels $C^{(12)}(p,\alpha)$ $E_p = 29$
6 events g.s. cc, 200 stars
12 events 3.2 *10* See also C^{12}

J.L.Need, Phys. Rev. 99, 1356 (1955).

B^{10}
5 5
stable

Levels $Be^{9}(d,n)$ $E_d = 0.695$ ppl
g.s.
(0.72)
(1.74)
(2.15)
(3.58) $l_n = 1$
d, n(θ)
d, n(θ) shows stripping for 3.58 level only

J.Génin, Compt. rend. 240, 2514 (1955).

Levels $Be^{9}(d,n)$ $E_d = 0.860$ ppl
g.s. $Q = 4.54$ *6*
0.75 *8*
1.79 *7*
2.23 *7*
3.77 *7* $l_n = 1$
d, n(θ)
d, n(θ) shows stripping for 3.77 level only

L.L.Green, J.P.Scanlon, J.C.Willmott, Proc. Phys. Soc. 68A, 386 (1955).

γ $Be^{9}(d,n\gamma)$ $E_d \leq 2.5$ sl pr
0.2* 4.54 *9* No Doppler corrections
0.4* 5.13 *9*
*Average σ in mb for $E_d = 0$ to 2.5
No γ with $6.5 < E_\gamma < 8.0$ for $E_d = 3.85$ (See Be^{10})

R.D.Bent, T.W.Bonner, J.H.McCrary, W.A. Ranken, R.F.Sippel, Phys. Rev. 99, 710 (1955).

Level $Be^{9}(p,\gamma)$ $E_p = 0.15$ to 0.52
6.86 $E_0 = 0.307$* scin($E_\gamma > 2.5$)
No resonance found for $E_p = 0.49$
Yield for $E_\gamma > 5.6$ shows non-resonant rise
*From Breit-Wigner fit with corrections for target thickness, barrier penetration

O.Lönsjö, O.Os, R.Tangen, Phys. Rev. 98, 727 (1955).

B^{10}
5 5
stable

Capture γ's $Be^{9}(p,\gamma)$ $E_p = 0.255$ to 0.495
6.89 level ($E_p = 0.33$) J = 1
~5† 0.41 *2* scin
100† 0.72 *2*
27† 1.03 *3*
5† 1.43 *3*
45†† 4.70 *15* scin pr
100†† 5.1 *1*
40†† 6.0 *1*
15†† 6.70 *15*
(1.03 γ)(0.72 γ)(θ) consistent with
J = 0^+, (1^+ or 2^+), 3^+
(5.1-Mev γ's)/proton = 1.2×10^{-10} for $E_p = 0.315$

R.R.Carlson, E.B.Nelson, Phys. Rev. 98, 1310 (1955); 95, 641A (1954).

B^{11}
5 6
stable

Level $C^{(12)}(t,\alpha)$ $E_t < 3.8$ ppl
$\sigma \leq 0.01$ g.s. $Q = 3.85$ Two events

P.Cüer, D.Magnac-Valette, G.Baumann, Compt. rend. 240, 1880 (1955).

Level $B^{(11)}(n,n'\gamma)$ $E_n = 4.5$; γ scin
2.20 *6*

G.L.Griffith, Phys. Rev. 98, 579 (1955).

Levels $B^{10}(d,p)$ $E_d = 0.18, 0.29, 0.41, 0.58$
l_n
6.4† g.s 1 ppl; scin
1.6† (2.14) 3 d, p(θ)
7.1† (4.46) 0
1.3† (5.03) 2
†∫dσ in mb at $E_d = 0.58$. σ's given at other E_d
d, p(θ) analyzed for stripping and compound nucleus formation

C.M.Paris, F.P.G.Valckx, P.M.Endt, Physica 20, 573 (1954).

Levels $B^{10}(d,p)$ $E_d = 3.90$
g.s. $l_n = 1$ d, p(θ)
(2.14) ~isotropic*
(4.46) $l_n = 1$
(5.03) ~isotropic*
(6.76) $l_n = 1$

S.A.Cox, R.M.Williamson, Phys. Rev. 99, 631A (1955); *verbal report.

γ $B^{10}(d,p)$ $E_d \leq 2.0$; sl pr
5.0* 4.49 *5* Doppler corrected
6.3* 4.73 *3* 6.0* 7.30 *3*
3.0* 5.03 *3* 1.8* 8.57 *4*
5.4* 6.75 *3*** 8.1* 8.93 *4*
*Average γ-production σ in mb for $E_d = 0$ to 2
**May be in both C^{11} and B^{11}

R.D.Bent, T.W.Bonner, J.H.McCrary, W.A. Ranken, R.F.Sippel, Phys. Rev. 99, 710 (1955).

B^{11}
5 6
stable

Levels $Li^{(7)}(\alpha,\alpha'+0.478\ \gamma)$ $E_\alpha \leq 2.8$
0.11† 9.86 $\Gamma = 0.125$ $J \leq 5/2$ if −
$J \leq 3/2$ if +
0.08† 10.23 $\Gamma \sim 0.155$ $J \leq 7/2$
No 10.32 level (< 0.006†)
Correction made for barrier penetration
J from comparison of reduced width with limit
†Peak cross section in barns

C.W.Li, R.Sherr, Phys. Rev. 96, 389 (1954).

$B^{10}(n,n)$ $E_n = 0.55, 1.00, 1.50$
Phase shifts found from n,n(θ)

H.B.Willard, J.K.Bair, J.D.Kington, Phys. Rev. 98, 669 (1955).

$Be^9(d,\gamma)$ $E_d = 1.5$
$\sigma < 2 \times 10^{-5}$ $Pr^{141}(\gamma,n)$ detection

H.R.Allan, N.Sarma, Proc. Phys. Soc. 68A, 535 (1955).

Levels $Be^9(d,t)$ $E_d = 0.58$ to 1.40
$Be^9(d,p)$ $E_d = 0.62$ to 1.40

Level	E_d*	Reaction
16.79 ?	1.19	(d,p)
16.87 ?	1.28**	(d,t)
16.97 ?	1.40	(d,p)

*E_d values for maxima in forward peak intensities which may mean resonance.
See also Berthelot et al., Stratton et al, O^{17}
**(t yield)/(p yield) has maximum

M.K.Jurić, Phys. Rev. 98, 85 (1955); Bull. Inst. Nuclear Sci., Boris Kidrich 5, 7 (1955); 3, 139 (1953).

B^{12}
5 7
0.03^s

γ $B^{(11)}(d,p\gamma)$ $E_d = 1.06$ scin
2† 0.940
1† 1.64

L.C.Thompson, Phys. Rev. 96, 369 (1954).

Levels $B^{10}(t,p)$ $E_t = 0.9$; ppl, scin
0.94 *10* 3.37 *10*
1.65 *10* 3.75 *10*
2.61 *10* 4.46 *10*

C.B.Bigham, K.W.Allen, E.Almqvist, Phys. Rev. 99, 631A (1955).

Levels $B^{11}(n,n)$ $E_n = 0.2$ to 1.50

∫dσ*	Level	E_0	J	l
7.5	(3.76)	(0.43)	2	1
4.7	(4.53)	(1.28)	3	2

*From n,n(θ)

H.B.Willard, J.K.Bair, J.D.Kington, Phys. Rev. 98, 669 (1955).

C^{11}
6 5
20.4^m

Levels $B^{10}(d,n)$ $E_d = 0.58$ ppl
d,n(θ)

		l_p
2.0†	g.s.	1
0.8†	(1.85)	3?
2.2†	(4.23)	0
0.7†	(4.77)	

†∫dσ in mb
d,n(θ) analyzed for stripping and compound nucleus formation

C.H.Paris, P.M.Endt, Physica 20, 585 (1954).

Levels $B^{11}(p,n)$ $E_p = 7.03$ ppl
st g.s. $Q = -2.80$ *6* 4 angles
2.04 *8*

F.Ajzenberg, A.Rubin, G.D.Johnson, M.Mazari, Phys. Rev. 100, 960A (1955).

γ $B^{10}(d,n)$ $E_d \leq 2.0$ sl pr
8.0* 6.50 *3* Doppler corrected
5.4* 6.75 *3***
*Average γ-production σ in mb for $E_d = 0$ to 2
**May be in both C^{11} and B^{11}

R.D.Bent, T.W.Bonner, J.H.McCrary, W.A. Ranken, R.F.Sippel, Phys. Rev. 99, 710 (1955).

Level $B^{10}(p,\gamma)$ $E_p = 0.78$ to 1.72
9.77 *4* $\Gamma = 0.57$ scin($E_\gamma \sim 9.7$)
No resonances at $E_p = 0.78$, 0.95, 1.33

T.M.Hahn, Jr., B.D.Kern, G.K.Farney, Phys. Rev. 98, 1183A (1955).

$B^{10}(p,\alpha)$
No resonances for $E_p = 0.08$ to 0.205, 115°
$\sigma(E_p = 0.200) = 0.66 \pm 0.09$ mb assuming α's are isotropic Magnetic analyzer

G.G.Bach, D.J.Livesey, Phil. Mag. 46, 824 (1955).

$B^{(10)}(p,\gamma)$ $20^m C^{11}$
$B^{(10)}(p,\alpha)$ $53^d Be^7$
No resonances for $E_p = 0.40$ to 0.75

J.W.G.Wignall, Australian J. Phys. 8, 310 (1955).

C^{12}
6 6
stable

Levels $B^{11}(d,n)$ $E_d = 0.60$ scin
g.s. $l_p = 1$ d,n(θ)
(4.43) n(θ) ~sym. about 90°

A.Ward, P.J.Grant, Proc. Phys. Soc. 68A, 637 (1955).

C^{12}
6 6
stable

Levels $B^{(11)}(d,n)$ $E_d = 1.6$ to 4.7
g.s. pc scin
(4.43)
$d,n(\theta)$ varies markedly with E_d

J.R.Risser, J.Price, C.M.Class, Phys. Rev. 98, 1183A (1955).

Level $C^{(12)}(n,n'\gamma)$ $E_n = 14$
4.4 γ scin
No 3.1γ (< 10% of 4.4γ) No $2.6, 6.0, 7.8\gamma$

L.E.Beghian, D.Hicks, B.Milman, Phil. Mag. 46, 924 (1955).

Level $C^{(12)}(n,n'\gamma)$ $E_n = 14$
$\sigma = 0.24$ 4.4 scin pr
No other γ with $1.6 < E_\gamma < 5.5$

M.E.Battat, E.R.Graves, Phys. Rev. 97, 1266 (1955).

Level $Be^9(\alpha,n\gamma)$ $E_\alpha = 5.3$
4.45 γ scin
No other γ observed

R.J.Breen, M.R.Hertz, Phys. Rev. 98, 599 (1955).

Levels $C^{(12)}(p,p')$ $E_p = 9.9$
g.s. $p,p(\theta)$*
(4.43) $p,p'(\theta)$**
*Diffraction effects observed
**Analyzed for direct collision and compound nucleus formation

G.E.Fischer, Phys. Rev. 96, 704 (1954).

Levels $C^{(12)}(p,p')$ $E_p = 9.5$ ppl
g.s. $\sigma(\theta)$ has a max. at 100°
(4.43) σ symmetric about 90°

W.E.Burcham, W.M.Gibson, A.Hossain, J.Rotblat, Phys. Rev. 92, 1266 (1953).

Levels $C^{(12)}(p,p')$ $E_p = 14$ to 19
g.s.
(4.43) σ asymmetric about 90°
(7.65)
(9.61)
$p,p'(\theta)$ does not fit direct interaction picture

R.Peelle, Phys. Rev. 98. 1184A (1955).

Levels $C^{(12)}(d,d')$ $E_d = 19$ ppl
g.s.
(4.43)
(9.61)
Group to level at 7.68 not observed
Graphs of $\sigma(\theta)$ given but not analyzed

R.G.Freemantle, W.M.Gibson, J.Rotblat, Phil. Mag. 45, 1200 (1954).

C^{12}
6 6
stable

Levels $B^{11}(d,n)$ $E_d = 0.86$ ppl
$d,n(\theta)$

	l_p
g.s.	1,2?
4.4	1
7.7	isotropic within 25%
9.6	2
12.7	

A.Graue, Phil. Mag. 45, 1205 (1954).

Levels $B^{11}(d,n)$ $E_d = 0.8$ ppl

11+	g.s.	Q = 13.81	$d,n(\theta)$*
28+	4.40		$d,n(\theta)$
7+	7.63	$\Gamma = 0.3$	
36+	9.71		$d,n(\theta)$*

+Relative intensities at 95°
*Similar, probably show stripping

M.A.Ihsan, Proc. Phys. Soc. 68A, 393 (1955).

Levels $C^{(12)}(e,e')$ $E_e = 80, 150, 187$
0.20* g.s. 0.02* (7.68)
0.16* (4.43) 0.05* (9.61)
$e,e(\theta)$ shows charge distribution intermediate between uniform and Gaussian
*$\sigma(E_e = 187, 90°)$ in μb. Other σ values given

J.H.Fregeau, R.Hofstadter, Phys. Rev. 99, 1503; 98, 1184A (1955).

Levels $B^{10}(He^3,p)$ $E_{He^3} = 0.9$ ppl
4.43 6 13.31 6 scin
7.77 6 13.97 6
9.61 6 15.10 6
10.75 6 16.04 6
11.83 6 16.57 6
12.76 6

C.B.Bigham, K.W.Allen, E.Almqvist, Phys. Rev. 99, 631A (1955).

Level $N^{(14)}(d,\alpha\gamma\gamma)$ $E_d = 0.63$ scin
(7.65)
$(3.2\gamma)(4.4\gamma)(\theta)$ consistent with J = 0, 2, 0

J.Seed, Phil. Mag. 46, 100 (1955).

Levels $C^{(12)}(n,n')3\alpha$ $E_n = 12$ to 20
6 events (7.7) ppl, 2000 stars
9.7 5
11 − 18
σ(broad max at $E_n = 15.5$) = 0.327
Evidence for Be^8 g.s., 2.9 level production

G.M.Frye, Jr., L.Rosen, L.Stewart, Phys. Rev. 99, 1375 (1955).

Levels $C^{(12)}(p,p')3\alpha$ $E_p = 29$
9.6 20 cc,
16 25 200 stars
See also Be^8

J.L.Need, Phys. Rev. 99, 1356 (1955); 98, 1538A (1955).

$^{12}_{6}C_{6}$
stable

$C^{(12)}(\gamma, 3\alpha)$ Li (0.5-Mev p,γ)
σ (12.3-Mev γ) = 0.12 ± 0.06 mb ppl
σ (14.8-Mev γ) = 0.033 ± 0.007 mb ppl
σ (17.6-Mev γ) = 0.170 ± 0.024 mb pc
Assumed relative γ intensities of 62 (17.6γ)
36(14.8γ), 2(12.3γ)

J.H.Carver, H.J.Hay, E.W.Titterton, Phil. Mag. 46, 841 (1955).

γ $C^{(12)}(p,p'\gamma)$* E_p = 30 to 340
$B^{11}(d,n\gamma)$ E_d = 18 to 50
15.2 *2* From T = 1 level? s pr
*σ(15.2-Mev γ) at 90° given
γ not produced by B^{10}(d), Be(p), B(p), O(p)
for above E_d and E_p nor by Be(170-Mev α)

D.Cohen, B.J.Moyer, H.Shaw, C.Waddell, Phys. Rev. 96, 714 (1954).

γ $B^{(11)}(d,n\gamma)$ E_d = 10.8 scin
100† 15.1
$N^{(14)}(d,\alpha\gamma)$ E_d = 10.8
3† ~15
$Be^9(\alpha,n\gamma)$ E_α = 21.7
6† ~15
Results consistent with assignment of
T = 1, J = 1^+ to 15.2 level in C^{12}

V.K.Rasmussen, J.R.Rees, M.B.Sampson, N.S.Wall Phys. Rev. 96, 812 (1954).

Level $B^{(11)}(p,\alpha)Be^8$ 2.9 level
16.10 J = 2 $\alpha,\alpha(\theta)$ E_p = 0.163
Data at E_p = 0.29 not explained by pure
1^-, 2^-, or 3^+ C^{12} state

E.H.Geer, E.B.Nelson, E.J.Wolicki, Phys. Rev. 98, 241A (1955).

Levels $B^{(11)}(p,\gamma)$ E_p = 0.6 to 2.0
(16.10) (18.39)
(17.22) (19.25)
p, (12-Mev γ)(θ); p, (16-Mev γ)(θ) as f(E_p)
show that more than two of above levels are
involved in interference scin

H.H.Givin, G.K.Farney, T.M.Hahn, B.D.Kern, Phys. Rev. 96, 1337; 95, 302A, 641A (1954).

Levels $B^{(11)}(p,\gamma)$ E_p = 0.5 to 3.0
16.56 ~16 γ not resonant
p(~12 γ)(θ) gives J = 2^-, 3^+
17.2 p(~16 γ)(θ) gives J = 1^-, 2^+
p(~12 γ)(θ) large cos term
18.4 p(~16 γ)(θ) gives J = 2^+
Both γ's weakly resonant

H.E.Gove, E.B.Paul, Phys. Rev. 97, 104 (1955).

$^{12}_{6}C_{6}$
stable

Levels $B^{(11)}(p,\alpha)$ E_p = 1.9 to 2.7
17.76 s 90°
18.34

R.E.Holland, D.R.Inglis, R.E.Malm, F.P.Mooring, Phys. Rev. 99, 92 (1955).

Resonance $C^{(12)}(\gamma,p_0)$ $E_\gamma \leq 23$
peak 21.5
No p group to B^{11} 2.14 level (< 25% of p_0)

A.K.Mann, W.E.Stephens, D.H.Wilkinson, Phys. Rev. 97, 1184; 98, 241A (1955).

Level $B^{10}(d,p)$ E_d = 0.15 to 0.7
25.36 scin
Irregularities in relative intensities of
four longest p groups observed at E_d = 0.21

C.H.Paris, F.P.O.Valckx, P.M.Endt, Physica 20, 573 (1954).

Resonance $C^{(12)}(\gamma, 3\alpha)$ $E_\gamma \leq 330$
peaks ~25 42 stars observed
~30 in ppl
No other resonances below 100 Mev

S.D.Softky, Phys. Rev. 98, 173 (1955).

Resonance $C^{(12)}(\gamma, 3\alpha)$ $E_\gamma \leq 100$
peak 27 σ_{max} ~ 0.25 mb ppl

A.M.Gurevitsch, Paper 2205, E.T.H.Zurich (1953); Phys. Abstr. 58, #3103 (1954).

$C^{(12)}(p,p'\alpha_i)2\alpha$ E_p = 340; ppl
Stars found such that p,α_i relations are
those expected in primary collisions

P.Cüer, A.Samman, J.Combe, Compt. rend. 240, 75, 1527 (1955).

$^{13}_{6}C_{7}$
stable

J 1/2 I
μ +0.702198
$\nu(C^{13})/\nu(H^1)$ = 0.2514431 *5*
Both nuclei in same molecule

V.Royden, Phys. Rev. 96, 543 (1954).

Level $C^{(12)}(d,p)$ E_d = 0.52 to 0.84
g.s. ppl
Values of $a_1 \ldots a_4$ in $\Sigma a_l P_l(\theta)$ for d,p(θ)

S.Takemoto, T.Dazai, R.Chiba, S.Ito, S.Suganomata, Z.Watanabe, J. Phys. Soc. Japan 9, 447 (1954).

$^{13}_{6}C_{7}$
stable

Level $C^{(12)}(d,p)$ E_d=1.86 to 3.45
g.s. ic, several angles
Forward peak intensity varies markedly as E_d goes through resonances (see N^{14})

K.W.Jones, M.T.McEllistrem, R.A.Douglas, D.F. Herring, E.Silverstein, Phys. Rev. 98, 241A (1955).

Levels $C^{(12)}(d,p)$ E_d = 19 ppl
d,p(θ)

	l_n
g.s.	1?
(3.08)	0
(3.89)	2

R.G.Freemantle, W.M.Gibson, J.Rotblat, Phil. Mag. 45, 1200 (1954).

Levels $C^{(12)}(d,p)$ E_d = 7.00
g.s. Q = 2.717 *10* sπ 90°
3.090
$\left.\begin{matrix}3.684\\3.855\end{matrix}\right\} \Delta Q = 0.170 \pm 0.003$
No 0.70, 4.6 level found (< 0.5% of g.s.)

A.Sperduto, W.W.Buechner, C.K.Bockelman, C.P.Browne, Phys. Rev. 96, 1316 (1954).

Level $C^{(12)}(d,p)$ E_d = 1.2
γ (3.09) E1 e^+e^-(θ) scin

S.Gorodetzky, R.Armbruster, P.Chevallier, A.Gallmann, Compt. rend. 239, 1623 (1954).

Level $C^{(12)}(d,p)$ E_d ~2.74
(3.09)
d,p(θ) studied. Large σ at 180°

M.T.McEllistrem, R.Chiba, R.A.Douglas, D.F. Herring, E.A.Silverstein, Phys. Rev. 99, 632A (1955).

Level $B^{(10)}(\alpha,p\gamma)$ E_α = 5.3
3.68 γ scin

R.J. Breen, M.R. Hertz, Phys. Rev. 98, 599 (1955).

γ $C^{(12)}(d,p\gamma)$ E_d = 4.0 sl pr

4.0*	3.76 *2*	No Doppler corrections
4.5*	3.86 *2*	

No γ's with 3.9 < E_γ < 5.8 (< 10% of 3.86 γ)
*Average σ in mb for E_p = 0 to 4.0

R.D.Bent, T.W.Bonner, R.F.Sippel, Phys. Rev. 98, 1237 (1955).

$^{13}_{6}C_{7}$
stable

Levels $B^{11}(He^3,p)$ E_{He^3} = 0.9 ppl scin

3.08 *6*	8.96 *6*
3.77 *6*	10.00 *6*
6.89 *6*	10.99 *6*
7.63 *6*	11.76 *6*

C.B.Bigham, K.W.Allen, E.Almqvist, Phys. Rev. 99, 631A (1955).

$C^{(12)}(n,n)$ E_n = 0.55, 1.00, 1.50
Phase shifts found from n,n(θ)

H.B.Willard, J.K.Bair, J.D.Kington, Phys. Rev. 98, 669 (1955).

Levels $C^{(12)}(n,n)$ E_n = 1.9 to 3.8

Level	E_o	J	l
6.87	2.08		≥2
7.67	2.95	3/2	2
8.32	3.65	3/2	2

Phase shift analysis of n,n(θ) C recoil
Old results corrected and extended

R.Budde, P.Huber, Helv. Phys. Acta 28, 49 (1955); 27, 512A (1954).

Levels $C^{(12)}(n,n)$ E_n = 2.4 to 3.7

E_o	Level	J	Γ
2.95	7.67	$3/2^+$	0.06
3.65	8.32	$3/2^+$	1.20

Phase shift analysis of n,n(θ) scin

R.W.Meier, P.Scherrer, G.Trumpy, Helv. Phys. Acta 27, 577 (1954).

Levels $C^{12}(d,p)$ E_d = 14.5 s

7.53 *2*		9.50 *2*
7.64 *2*	Γ > 0.1	9.90 *2*

J.N.McGruer, E.K.Warburton, R.S.Bender, Phys. Rev. 99, 632A (1955); verbal report.

Levels $C^{(12)}(n)$ E_n = 4.4 to 5.5,
7.5 to 8.7
9.57
9.95
12.17
12 - 13 broad peak

R.L.Becker, R.B.Perkins, H.H.Barschall, Phys. Rev. 99, 1646A (1955).

$Be^9(\alpha,\gamma)$ E_α = 1.6
σ < 2×10^{-5} scin

H.R.Allan, N.Sarma, Proc. Phys. Soc. 68A, 535 (1955).

C^{14}
6 8
~5600^y

β^- 0.155 *1* F-K linear above 0.03
Source thickness ~15 $\mu g/cm^2$ sl

H.H.Forster, A.Oswald, Phys. Rev. 96,1030 (1954).

β^- 0.1585 *5* F-K linear (E_β >0.007)
Source thickness ~6 $\mu g/cm^2$

A.V.Pohm, R.C.Waddell, J.P.Powers, E.N.Jensen, Phys. Rev. 97, 432 (1955).

Comparison with S^{35} shows β spectrum has
allowed shape down to 3 kev pc

A.Moljk, S.C.Curran, Phys. Rev. 96, 395(1954).

Levels $C^{(13)}(d,p)$ E_d = 5.0 to 7.0
g.s. Q = 5.942 *11* SM 90°
6.091
6.723
6.894
$\left.\begin{matrix}6.723\\6.894\end{matrix}\right\}$ ΔQ = 0.171 ± 0.003

A.Sperduto, W.W.Buechner, C.K.Bockelman, C.P.Browne, Phys. Rev. 96, 1316 (1954).

Level $C^{(12)}(t,p)$ E_t < 3.8 ppl
6.1 Q = -1.5 One event
Expected reaction to C^{14} g.s. not observed

P.Cüer, D.Magnac-Valette, G.Baumann, Compt. rend. 240, 1880 (1955).

γ $C^{13}(d,p\gamma)$ E_d = 2.4 sl pr
4.1,52* 6.14 *3* No Doppler corrections
25,26* 6.72 *3*
No 6.9 γ (<10% of 6.72 γ)
*Average σ in mb for E_d = 1 to 2, 3.4 to 4

R.D.Bent, T.W.Bonner, R.F.Sippel, Phys. Rev. 98, 1237 (1955); 95, 649A (1954).

γ $C^{13}(d,p\gamma)$
0.811 *3* E_d = 2.6* sl pe
6.120 *25* E_d = 1.42 sl Cp
6.73 *4* E_d = 1.9 sl Cp
No Doppler corrections *Threshold at 1.9

R.J.Mackin, Jr., W.B.Mims, W.R.Mills, Jr., Phys. Rev. 98, 43 (1955); 93, 950A (1954).

Levels* $C^{13}(d,p)$ E_d = 14.5 s
6.59 *2* 10.50 *2*
7.35 *2* 12.60 *2*
8.32 *2* 12.85 *2* Γ>0.1
9.80 *2* 12.96 *2*
10.43 *2*
*In addition to four previously known

J.N.McGruer, E.K.Warburton, R.S.Bender, Phys. Rev. 99, 632A (1955).

C^{15}
6 9
2.4^s

Level $C^{14}(d,p)2.4^sC$ E_d = 0.6 to 3.0
g.s. Q = 0.15 *15* scin
Q = 0.12 *5**
Excitation curve gives J(g.s.) = 5/2, not 1/2

J.A.Rickard, E.L.Hudspeth, W.W.Clendenin, Phys. Rev. 96, 1272 (1954); Phys. Rev. 94, 806A (1954); *K.R.Spearman, quoted in first reference.

N^{13}
7 6
10.1^m

β^+ 1.185 *25* $C^{(12)}$(0.75-Mev d,n); a
No γ a

T.Grabowski, L.Natanson, Bull. Acad. Polon. Sci., Cl.3, 2, 379 (1954).

Capture γ $C^{(12)}(p,\gamma)$ E_p = 1.37, 1.58
$p,\gamma(\theta) = (0.02 \pm 0.02) + \sin^2\theta$ for γ to 2.37 level

S.A.Heiberg, D.B.James, T.K.Alexander, Can. J. Phys. 33, 34 (1955).

N^{14}
7 7
stable

Hyperfine splitting of ^4S g.s. of atomic N
observed but no evidence of q Mic

M.A.Heald, R.Beringer, Phys. Rev. 96, 645 (1954).

q +0.0071
Calculated from q coupling of HCN* using
self-consistent field wave function

A.Bassompierre, Compt. rend. 240, 285 (1955); *Simmons, et al., Phys. Rev. 77, 77 (1951).

Levels $C^{(13)}(d,n)$ E_d = 0.92 ppl
g.s. Q = 5.325 *40*
2.30 *5*
3.95 *3* single
4.95 *2* double ?
Pronounced forward peaks observed

J.R.Bird, Australian J. Phys. 8, 314 (1955).

Levels $C^{13}(d,n)$ E_d = 0.86 ppl
g.s.
2.34 *7*
4.02 *7*
5.02 *7* l_n = 0
5.20 *7*
d,n(θ)
d,n(θ) shows stripping for 5.02 level only

L.L.Green, J.P.Scanlon, J.C.Willmott, Proc. Phys. Soc. 68A, 386 (1955).

N^{14}
7 7
stable

Levels $N^{(14)}(p,p')$ $E_p = 9.5$ ppl

100†	g.s.	$\sigma(\theta)$ has a max at ~100°
≤ 1†	(2.31)	
7†	(3.95)	σ symmetric about 90°
	(4.91)	
	(5.10)	

†Relative numbers of p's at 90°

R.G.Freemantle, D.J.Prowse, J.Rotblat, Phys. Rev. 96, 1268 (1954).

Level $N^{(14)}(p,p'\gamma)$ $E_p = 3.92$
γ (2.31) $\tau \sim 2 \times 10^{-13}$s scin
Doppler effect $\Delta E/E \sim 0.01$

J.Thirion, R.Barloutaud, Compt. rend. 240, 2136 (1955).

Level $B^{(11)}(\alpha,n\gamma)$ $E_\alpha = 5.3$
2.36 γ scin

R.J.Breen, M.R.Hertz, Phys. Rev. 98, 599 (1955).

γ $C^{13}(d,n\gamma)$

	0.729 *3*	$E_d = 2.6$ sl pe
0.14+	3.91 *5*	$E_d = 1.42$ sl Cp
0.37+	4.93 *4*	
0.34+	5.13 *3*	
0.45+	5.73 *3*	
	6.45 *5*	$E_d = 1.9$ sl Cp

+Relative yield at $E_d = 1.42$
No Doppler corrections

R.J.Mackin, Jr., W.B.Mims, W.R.Mills, Jr., Phys. Rev. 98, 43 (1955); 93, 950A (1954).

γ $C^{13}(d,n\gamma)$ sl pr

19*	3.42 *3*		$E_d = 2.0$
5.3*	3.71 *5*	N^{14} or C^{13}?	
3.3*	3.94 *6*	N^{14} or C^{13}?	
3.5*	4.48 *4*	N^{14}, C^{14}, or B^{11}?	
9.7*	4.96 *3*		
11*	5.12 *4*		
9.1*	5.74 *3*		
3.3*, 9.7**	6.53 *4*		$E_d = 4.0$
8.2**	7.09 *3*		
3.1**	7.34 *4*		

*Average σ in mb for $E_d = 1.0$ to 2.0
**Average σ in mb for $E_d = 3.4$ to 4.0
No Doppler corrections

R.D.Bent, T.W.Bonner, R.F.Sippel, Phys. Rev. 98, 1237 (1955); 95, 649A (1954).

Levels $N^{(14)}(\alpha,\alpha')$ $E_\alpha = 22$

7.01 *6*		12.5°, 79°, 90°
7.94 *7*		
8.45 *7*	composite?	
10.05 *7*	composite?	

Levels at 7.4, 7.7, 8.06, 9.49 not observed

D.W.Miller, U.C.Gupta, V.K.Rasmussen, M.B.Sampson, Phys. Rev. 98, 1184A (1955).

N^{14}
7 7
stable

$C^{13}(p,\gamma)$
8.06 level $E_p = 0.554$

γ	17†	1.66	1†	5.7 ?	scin pr
	15†	2.35	100†	8.05	
	13†	4.05			

(4.05 γ) (1.66 γ) (2.35 γ)
4.01 crossover 5 ± 5% of 2.35 γ

B.Hird, C.Whitehead, J.Butler, C.H.Collie, Phys. Rev. 96, 702 (1954).

Level $C^{13}(p,\gamma)$ $E_p = 3.11$; scin
γ 10.43 $\Gamma = 0.08$ $J = 2-$ $p,\gamma(\theta)$
(Channel spin 0)/(channel spin 1) = 1.5

H.B.Willard, J.D.Kington, J.K.Bair, Phys. Rev. 98, 1184A (1955).

Resonance peaks $N^{(14)}(\gamma,n)$

10.8 ?		10^m N^{13} and
11.5	$\Gamma \sim 0.3$	n's detected
12.7	$\Gamma \sim 1$	

B.G.Chidley, L.Katz, Phys. Rev. 99, 1646A (1955).

Levels $C^{(12)}(d,p)$ $E_d = 1.86$ to 3.45
lc, several angles

12.02	
12.27	
12.41	12.76 ?
12.55 ?	12.84
12.61	12.92

K.W.Jones, M.T.McEllistrem, R.A.Douglas, D.F. Herring, E.Silverstein, Phys. Rev. 98, 241A (1955).

Levels $C^{12}(d,p)$ $E_d = 2.0$ to 5.0
12.43
12.60
12.86
13.02
13.63
14.34

d,p(θ) shows compound nucleus formation and stripping

T.W.Bonner, A.A.Kraus, Jr., J.T.Eisinger, J.B. Marion, Phys. Rev. 99, 631A (1955).

Levels $C^{(12)}(d,d)$ $E_d = 2.5$ to 3.4
12.41*
12.61*
12.80*
12.82*
12.93*
13.17

*Also observed in (d,p)

M.T.McEllistrem, R.Chiba, R.A.Douglas, D.F. Herring, E.A.Silverstein, Phys. Rev. 99, 632A (1955).

N^{14}
7 7
stable

Levels $B^{10}(\alpha,p_0)$ $E_\alpha = 1.4$ to 2.4; ic
$B^{10}(\alpha,n)$ Mn act. and n scin

	n/p	α, (n or p)(θ)
12.69	2.3 *2*	1-0.9 $\cos^2(\theta)$
13.15	~1	1-0.5 $\cos^2(\theta)$

E.S.Shire, R.D.Edge, Phil. Mag. 46, 640 (1955).

$C^{(12)}(d,\gamma)$ $E_d = 1.5$
$\sigma < 10^{-6}$ $Pr^{141}(\gamma,n)$ detection

H.R.Allan, N.Sarma, Proc. Phys. Soc. 68A, 535 (1955).

$C^{(12)}(d,n)N^{13}$ g. s. $E_d \leq 20$

For $E_d > 6$, σ falls more slowly than expected for compound nucleus formation.
$\sigma(E_d = 8) = 0.1$

$C^{(12)}(d,t)$

σ(E) suggests pick up

D.H.Wilkinson, Phys. Rev. 99, 632 A (1955).

$N^{(14)}(\gamma,\alpha)$ $E_\gamma \leq 31$ ppl

σ shows structure for $E_\gamma = 14.5$ to 30($\leq$0.2mb)

P.Stoll, Helv. Phys. Acta 27, 395 (1954).

N^{15}
7 8
stable

Levels $N^{(14)}(d,p)$ $E_d = 11.9$ scin

g.s.	$l_n = 1$	d,p(θ)
(~5.3)		forward max observed

F.S.Eby, Phys. Rev. 96, 1355 (1954).

Levels $N^{(14)}(d,p)$ $E_d = 5$ to 8
$s\pi$ 90°

Level	ΔQ
5.280 *10*	
6.330 *10*	
7.165 *10*	0.149 *4*
7.314 *10*	0.263 *5*
7.575 *10*	
8.316 *10*	0.258 *4*
8.571 *10*	
9.062 *10*	0.103 *4*
9.165 *10*	
9.834 *10*	0.239 *6*
10.069 *10*	
10.458 *10*	0.085 *3*
10.544 *10*	0.160 *4*
10.705 *10*	0.106 *3*
10.811 *10*	

Level values based on g.s. Q= 8.615

A.Sperduto, W.W.Buechner, C.K.Bockelman, C.P.Browne, Phys. Rev. 96, 1316 (1954).

N^{15}
7 8
stable

Levels $N^{14}(d,p)$ $E_d = 7$ ppl
d,p(θ)

Level	l_n
(5.28)	2
(5.31)	~isotropic
(6.33)	1
(7.16)	2
(7.31)	0
(7.58)	0 and 2
(8.32)	0
(8.57)	0 and 2

R.D.Sharp. A.Sperduto, W.W.Buechner, Phys. Rev. 99, 632A (1955); verbal report.

γ $N^{(14)}(d,p\gamma)$ $E_d = 1.05$ scin

5†	0.84
100†	1.88
280†	5.3

.C.Thompson, Phys. Rev. 96, 369 (1954)

γ $N^{(14)}(d,p\gamma)$ $E_d \leq 4.0$; sl pr

20*	5.29 *3***	No Doppler corrections
3.0*	6.36 *4*	9.17 *5*
4.5*	7.34 *3*	10.08 *3*
14*	8.37 *4*	10.77 *7*

*Average γ-production σ in mb for $E_d = 0$ to 4
**May be in both O^{15} and N^{15}

R.D.Bent, T.W.Bonner, J.H.McCrary, W.A. Ranken, R.F.Sippel, Phys. Rev. 99, 710; 98, 1198A (1955).

Levels $C^{14}(p,n)$ $E_p = 0.25$ to 1.8
$C^{14}(p,\gamma)$ BF_3,scin

		kev			ev
J	Level	Γ	Γ_n	Γ_p	$\Gamma_\gamma(\gamma_0)$
1/2-	11.30*	12	1.6	10.4	0.25
(1/2+)	11.43**	41	33	8	2.3
1/2+	11.61**	475	5	470	28

*p,n(θ) isotropic, pγ_0(θ) has cos θ term
**p,n(θ) and p,γ_0(θ) isotropic

G.A.Bartholomew, F.Brown, H.E.Gove, A.E.Litherland, E.B.Paul, Phys. Rev. 96, 1154 (1954).

Levels $N^{(14)}(n,n)$ $E_n = 0.80$ to 2.36

E_0	Level	J*	
(1.120)	(11.879)	$3/2^-$	n,n(θ)
(1.350)	(12.094)	+?	N^{14} recoils and
(1.401)	(12.142)	$3/2^-$	scattered n's
(1.595)	(12.323)	$3/2^-$	observed
(1.779)	(12.515)	$5/2^+$	
(2.25)	(12.93)	$3/2^-$	

*From theoretical fits to n,n(θ)
Potential scattering phase shifts calculated from off-resonance n,n(θ)

J.C.Fowler, C.H.Johnson, Phys. Rev. 98, 728 (1955).

N^{15}
7 8
stable

Levels $B^{11}(\alpha,n)$ $E_\alpha = 1.4$ to 2.4
$\underline{\alpha,n(\theta)}$ scin
12.10 Strong forward and back
12.15 ~Isotropic
12.49 Strong forward

E.S.Shire, R.D.Edge, Phil. Mag. 46, 640 (1955).

Levels $N^{(14)}(n,n)$ $E_n = 2.6$ to 4.2

	J	
13.2	$7/2^+$	$n,n(\theta)$
13.6	$5/2^+$	
13.8	$3/2^+$	
14.1	$5/2^+$?	
14.3	$5/2^+$	
14.4	$7/2^+$?	
14.7	$5/2^+$	

D.Speiser, Helv. Phys. Acta 27, 427, 159A; P.Huber, H.R.Striebel, Helv. Phys. Acta 27, 157A (1954).

N^{16}
7 9
7.4^s

Level $C^{14}(d,p)2.4^sC$ $E_d = 0.6$ to 3.0
12.35 $\Gamma = 0.4$ scin($E_\gamma > 2$)
Level value based on g.s. $Q = 10.47$

J.A.Rickard, E.L.Hudspeth, W.W.Clendenin, Phys. Rev. 96, 1272 (1954).

O^{15}
8 7
2.1^m

τ 2.06^m *2* $O^{(16)}(\le 25\text{-Mev } \gamma,n)$

R.M.Kline, D.J.Zaffarano, Phys. Rev. 96, 1620 (1954).

τ 2.02^m *5*

Level $N^{(14)}(p,\gamma)$ $E_p = 0.295$
$\underline{7.61 \text{ level} \quad J = 5/2\pm \quad \Gamma_\gamma = 0.013 \text{ ev}}$

γ			
25+	5.25 *10*	scin pr 0°	($E_\gamma > 4.5$)
100+	6.10 *10*		
40+	6.65 *15*		

No 7.61γ (< 5+)
6.10γ /5.25γ = 3.72 ± 0.12 at 90°

S.Bashkin, R.R.Carlson, E.B.Nelson, Phys. Rev. 99, 107; 98, 1184A (1955).

γ $N^{(14)}(d,n)$ $E_d = 4.0$; sl pr
20* 5.29 *3* **No Doppler corrections
3.0* 6.15 *5*
9.7* 6.84 *3*
*Average γ-production σ in mb for $E_d = 0$ to 4
**May be in both N^{15} and O^{15}

R.D.Bent, T.W.Bonner, J.H.McCrary, W.A. Ranken, R.F.Sippel, Phys. Rev. 99, 710; 98, 1198A (1955).

O^{15}
8 7
2.1^m

Levels $N^{(14)}(p,p' + 2.31\gamma)$
$E_p = 3$ to 4.9 scin
11.01 *3* $\Gamma = 0.082$
11.07 *3* $\Gamma < 0.015$
11.97 *4*

J.Thirion, R.Barloutaud, Compt. rend. 240, 2136 (1955).

O^{16}
8 8
stable

γ $F^{19}(p,\alpha\gamma)$ $E_p = 1.05$ scin
(6.06) $0 \longrightarrow 0$ $e^+e^-(E_e, \theta)$

S.Gorodetzky, R.Armbruster, P.Chevallier, A.Gallmann, R.Manquenouille, Compt. rend. 241, 482, 698 (1955); J. phys. radium 16, 594 (1955).

Level $O^{(16)}(n,n'\gamma)$ $E_n = 14$
6.1 γ scin
6.9 and 7.1γ possibly present also
No 3.0, 3.8, 5.2γ

L.E.Beghian, D.Hicks, B.Milman, Phil. Mag. 46, 924 (1955).

Levels $F^{19}(p,\alpha)$ $E_p = 0.873$ to 1.431
6.14 $J = 3^-$ $p,\alpha(\theta)$
6.91 $\Gamma \sim 0.006$ $J = 2^+$ sr
7.12 $\Gamma \sim 0.006$ $J = 1^-$
No evidence for doublets at 6.91, 7.12
No level between 7.12 and 8.7
No evidence for 2^- level from $p,\alpha(\theta)$

R.W.Peterson, W.A.Fowler, C.C.Lauritsen, Phys. Rev. 96, 1250 (1954); 93, 1085A (1953).

Levels $F^{19}(p,\alpha)$ $E_p = 0.340, 0.873, 0.935$
6.13 $5\times10^{-12} \le \tau \le 10^{-11}$s
6.9 $\tau \le 1.2\times10^{-14}$s
7.1 $\tau \le 8\times10^{-15}$s
From measurement of Doppler shift

S.Devons, G.Manning, D.P.Bunbury, Proc. Phys. Soc. 68A, 18 (1955).

γ $F^{19}(p,\alpha\gamma)$ $E_p \le 3.7$; sl pr
2.7* 6.10 *4* No Doppler corrections
3.7* 6.99 *4*
No γ's with $7.5 < E_\gamma < 11$ (< 10% of 6.99γ)
*Average σ in mb for $E_p = 0$ to 3.7

R.D.Bent, T.W.Bonner, R.F.Sippel, Phys. Rev. 98, 1237 (1955).

O^{16}
8 8
stable

Levels $O^{(16)}(p,p')$ $E_p = 19$ scin
40° to 165°

58*	~6		
34*	~7	20*	11.08
28*	8.85	11*	11.51
8*	9.84	6*	12.03
8*	10.34	11*	12.52

*$\int \sigma d\theta$ in mb

R.Sherr, W.F.Hornyak, Phys. Rev. 99, 632A (1955).

Level $F^{19}(p,\alpha)$ $E_p = 3.1$ to 4.1
8.85 *2* $J = 2-$
Level indicated by γ's and coincidences

γ	vw	1.71 *2*	scin pr
	w	1.92 *2*	
		2.73 *2*	

$(2.73\gamma)(6.14\gamma)$ $(6.3 < E_\gamma < 8)(1.71\gamma, 1.92\gamma)$

B.J.Toppel, D.H.Wilkinson, D.E.Alburger, Phys. Rev. 99, 632A(1955).

Levels $O^{(16)}(p,p'\gamma)$ $E_p = 19$ scin

Level	Coincidences
(8.85)	$p(\sim 2.4\gamma)$ $\gamma(\sim 6, \sim 7\gamma)$
(9.85)	No γ
(11.08)	$p\gamma$ $\gamma(\sim 6, \sim 7\gamma)$
(12.03)	$p\gamma$?
(12.52)	$p(C^{12}\ 4.4\gamma)$

W.F.Hornyak, R.Sherr, Phys. Rev. 99, 632A (1955).

Levels $C^{(12)}(\alpha,\alpha)$ $E_\alpha = 4.0$ to 7.6

	J	Γ	
10.36	4+	0.036	$\alpha,\alpha(\theta)$
11.10 ?		0.010	
11.25	0+	3.3	
11.51	2+	0.11	
11.62	3−	1.6	
12.43	1−	0.23	

J.W.Bittner, R.D.Moffat, Phys. Rev. 96, 374 (1954); 94, 769A (1954).

Levels $O^{(16)}(\gamma,\alpha)$ $E_\gamma \le 31$ ppl

14.2 ?	22.6
16.8	23.2 ?
17.3	24.6 ?

J = 2, T = 0 for above levels from $\gamma,\alpha(\theta)$
$\sigma(E_\gamma = 17.6) = 0.15$ mb

P.Stoll, Helv. Phys. Acta 27, 395(1954).

Resonance $O^{(16)}(\gamma,p)$ $E_\gamma \le 18.7$ ppl
peak ~14.7
$\gamma,p(\theta)$ shows excitation is E2 or M1
Possibly lowest state of surface oscillation*

B.M.Spicer, Phys. Rev. 99, 33 (1955); *D.H. Wilkinson, Phys. Rev. 99, 1347 (1955).

O^{16}
8 8
stable

Resonance $O^{16}(\gamma,p_o)$ $E_\gamma \le 25$
ppl 30° to 150°

peaks	
st	14.7
w	19.6
w	20.6
st	22.4*

*p groups also to N^{15} 5.3 and 6.3 levels

W.E.Stephens, A.K.Mann, B.J.Patton, E.J. Winhold, Phys. Rev. 98, 839 (1955).

Levels $O^{(16)}(\gamma,p)$ $E_\gamma \le 21$; ppl
E_p histogram shows peaks corresponding to principal breaks in (γ,n) activation curve

S.A.E.Johansson, B.Forkman, Phys. Rev. 99, 1031 (1955).

O^{17}
8 9
stable

Level $O^{(16)}(d,p)$ $E_d = 0.58$ to 1.40
g.s. $d,p(\theta)$ ppl
Forward peak intensity ($l_n = 2$?) is greatest for $E_d = 0.98$, 1.14 See F^{18}

M.K.Jurić, Phys. Rev. 98, 85 (1955); M.K.Jurić, M.M.Petrović, Bull. Inst. Nuclear Sci., Boris Kidrich 5, 1 (1955).

Level $O^{(16)}(d,p)$ $E_d = 1.6$ to 2.2
(0.87) $l_n = 0$ $d,p(\theta)$ ppl
Forward peak intensity greatest at resonance, $E_o = 2.06$

A.Berthelot, R.Cohen, E.Cotton, H.Faraggi, T.Grjebine, A.Leveque, V.Naggiar, M.Roclawski-Conjeaud, D.Szteinsznaider, J. phys. radium 16, 241 (1955).

Levels $O^{(16)}(d,p)$ $E_d = 1.1$ to 2.4
g.s.*
(0.87)**
*Stripping process still present at $E_d = 1.1$
**Stripping process not present at $E_d = 1.1$

J.C.Grosskreutz, Phys. Rev. 99, 643A (1955).

Levels $O^{(16)}(d,p)$ $E_d = 2.6, 3.0, 3.3, 3.4$
g.s. $l_n = 2$* $d,p(\theta)$ pc
(0.87) $l_n = 0$**
*Forward peak intensity greatest for $E_d = 3.01$, 3.43 (near resonances). See F^{18}.
**Distribution shifts with E_d but no general trend observed
Absolute values of σ given

T.F.Stratton, J.M.Blair, K.F.Famularo, R.V. Stuart, Phys. Rev. 98, 629 (1955).

γ $O^{(16)}(d,p\gamma)$ $E_d = 2.6$; sl pe
0.869 *3* No Doppler correction

R.J.Mackin, Jr., W.B.Mims, W.R.Mills, Jr., Phys. Rev. 98, 43 (1955).

O^{17}
8 9
stable

Levels $O^{(16)}(d,p)$ $E_d = 5.0$ to 8.5
g.s. $Q = 1.915$ *10* 8π 90°
0.875 *12*
3.055 *12*
3.840 *12*

A.Sperduto, W.W.Buechner, C.K.Bockelman, C.P.Browne, Phys. Rev. 96, 1316 (1954).

Levels $O^{(16)}(n,\alpha)$ $E_n = 3.6$ to 4.2
18* 7.81 *2* $\Gamma \leq 0.1$ O_2 filled
82* 7.95 *2* $\Gamma \leq 0.1$ ic
*σ in mb

J.Seitz, P.Huber, Helv. Phys. Acta 28, 227 (1955).

Levels $C^{(13)}(\alpha,n)$ $E_\alpha = 1.6$ to 3.8
8.06 0°, 90°
~8.21 8.51
8.34* 8.70
8.41 8.91
8.47 8.96
*Observed at 90° only

R.B.Walton, R.L.Becker, J.D.Clement, M.S. Zucker, Phys. Rev. 99, 1649A (1955).

$C^{13}(\alpha,n)$ $E_\alpha = 5.3$
$\sigma = 10 \pm 1$ mb. n yield 1/30 that from $Be^9(\alpha,n)$

M.E.Nahmias, P.Savel, Compt. rend. 239, 761 (1954).

O^{18}
8 10
stable

Level $O^{17}(d,p)$ $E_d = 0.855$ sd
g.s. $Q = 5.821$ *10* 61°, 135°
1.986 *13*

K.Ahnlund, Phys. Rev. 96, 999 (1954).

Levels $O^{17}(d,p)$ $E_d = 1.4$, 2.0; 90°
g.s. not observed s
1.977 $Q = 3.861$ *16*
2.445 $Q = 3.393$ *16*

H.D.Holmgren, T.D.Hanscome, D.K.Willett, Phys. Rev. 98, 241A (1955).

O^{19}
8 11
29.4^s

β^- (2.9) log ft = 4.3
(4.5) log ft = 5.6
γ intensities show log ft ≥ 5.3, ≥ 7.3, ≥ 6.5 for transitions to 1.37, 0.112, g.s. F^{19} levels

γ_1 4† 0.112 *2* $\tau \ll 10^{-6s}$
γ_2 100† 0.200 *2* $\tau = 1.0 \pm 0.2 \times 10^{-7s}$
γ_3 67† 1.366 *8*
$\gamma_2\gamma_3(\theta)$ supports decay scheme. See F^{19}.
No 0.22 γ (< 0.04†) No 1.59 γ (< 0.03†)

G.A.Jones, W.R.Phillips, C.M.P.Johnson, D.H.Wilkinson, Phys. Rev. 96, 547 (1954).

O^{19}
8 11
29.4^s

Levels $O^{18}(d,p)$ $E_d = 0.855$ sd
g.s.? $Q = 1.730$ *8* 61°, 135°
0.094 *11*
1.468 *10*

C.Milelkowsky, K.Ahnlund, Phys. Rev. 96, 996 (1954); Arkiv Fysik 8, 161 (1954).

Levels $O^{18}(d,p)$ $E_d = 1.4, 2.0$; 90°
g.s. $Q = 1.735$ *8* s
0.094 *8*
1.471 *13*

H.D.Holmgren, T.D.Hanscome, D.K.Willett, Phys. Rev. 98, 241A (1955).

Level $O^{18}(d,p)$ $E_d = 3.01$ s
(1.47) $Q = 0.3$ *2* ppl
$\sigma(5°) = 0.213$ b/sterad $l_n = 0$ d,p(θ)

T.F.Stratton, J.M.Blair, K.F.Famularo, R.V. Stuart, Phys. Rev. 98, 629 (1955); 96, 825A (1954).

F^{17}
9 8
66^s

Levels $N^{(14)}(\alpha,n)$ pc; n thresh
g.s. $Q = -4.8$ *1*
0.53

W.T.Doyle, A.B.Robbins, Phys. Rev. 98. 1185A. (1955); verbal report.

F^{18}
9 9
1.87^h

τ 1.85^h *2* $O^{(16)}(t,n)$
σ given for $E_t = 0.7$ to 2.1

N.Jarmie, Phys. Rev. 98, 41 (1955).

Capture γ's $N^{(14)}(\alpha,\gamma)$ $E_\alpha = 1.2$ to 2.2
5.60 *2* level Γ < 1.5 kev scin

3* 0.945 *10*
3* 1.075 *10* 3* 3.00 *5*
3* 2.10 *5* 2.2* 4.57 *2* α,γ(θ)
3* 2.55 *5* 0.7* 5.6 *1* α,γ(θ)

5.67 *2* level Γ < 1.0 kev

2* 1.075 *10*
2* 2.05 *10* 2* 2.9 *2*
2* 2.55 *5* 2.2* 4.59 *3* α,γ(θ)
*Effective radiation width in ev
(4.57 γ)(1.075 γ) delay < $5^{\mu s}$
Possible J's for 1.075, 5.60, 5.67 levels given

P.C.Price, Proc. Phys. Soc. 68A, 553 (1955).

Levels $N^{(14)}(\alpha,p)$ $E_\alpha = 5.30$ cc

	α,p(θ)
6.0	$1 - 0.64 \cos\theta - 1.2 \cos^2\theta$
7.2	$1 - 1.1 \cos^2\theta$
7.8	$1 - 1.1 \cos^2\theta$

G.S.Mani, R.Pandhi, Proc. Indian Acad. Sci. 40A, 61 (1954).

F^{18}
9 9
1.87^h

Levels $O^{(16)}(d,p)$ See O^{17}
8.39 ? $E_d = 0.98$* ppl
8.53 ? $E_d = 1.14$*

*E_d values for maxima in forward peak intensities which may mean resonance. See also Berthelot et al, Stratton et al, O^{17}.

M.K.Jurić, Phys. Rev. 98, 85 (1955); M.K. Jurić, M.M.Petrović, Bull. Inst. Nuclear Sci., Boris Kidrich 5, 1 (1955).

Levels $O^{(16)}(d,p)$ $E_d = 1.6$ to 2.2; pc

Level	E_o*	p group
9.0 ?	1.7 ?	p_1 ?
9.33	2.06	p_1

*From yield at several angles

A.Berthelot, R.Cohen, E.Cotton, H.Faraggi, T.Grjebine, A.Leveque, V.Naggiar, M.Roclawski-Conjeaud, D.Steinsznaider, J. phys. radium 16, 241 (1955).

$O^{16}(d,\gamma)1.87^h F^{18}$ $E_d = 1.7$
$\sigma \sim 0.01$ mb
$O^{17}(d,n)1.87^h F^{18}$ $E_d = 1.7$
$\sigma \sim 30$ mb

J.W.Butler, Phys. Rev. 99, 643A (1955).

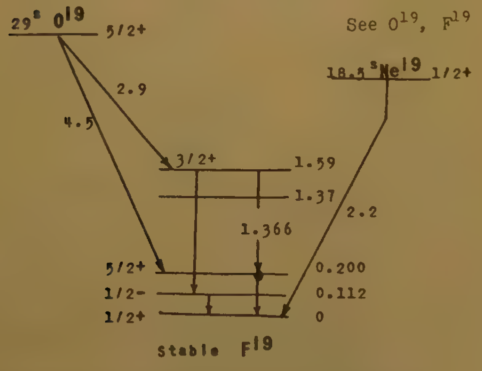
Levels $O^{(16)}(d,p)$ $E_d = 2.2$ to 3.8

Level	E_o	p group	
10.09	2.93	p_o	pc
10.50	3.39	p_o	53°
10.74	3.67	p_o	

See O^{17} for $d,p(\theta)$ results

T.F.Stratton, J.M.Blair, K.F.Famularo, R.V. Stuart, Phys. Rev. 98, 629 (1955).

F^{19}
9 10



See O^{19}, F^{19}

G.A.Jones, W.R.Phillips, C.M.P.Johnson, D.H.Wilkinson, Phys. Rev. 96, 547 (1954).

F^{19}
9 10
stable

Levels $F^{19}(p,p')$ $E_p = 2.2$ to 4.5 s
g.s.
0.1104 *6*
0.1978 *12*
No multiplet structure (resolution 3 kev)
No other levels below 0.73 (< 2% of g.s.)

C.R.Gossett, G.C.Phillips, J.T.Eisinger, Phys. Rev. 98, 724 (1955).

F^{19}
9 10
stable

Levels $F^{19}(p,p')$ $E_p = 1.431$
0.1088 *8* $p,p'(\theta)$
0.1960 *14*
See Ne^{20} for σ's

R.W.Peterson, W.A.Fowler, C.C.Lauritsen, Phys. Rev. 96, 1250; 94, 1075, 951A (1954).

Levels $F^{19}(p,p'\gamma)$ $E_p = 0.7$ to 1.8; scin
γ_1 0.110 *1*
γ_2 0.1975 *15* $\epsilon B(E2) = 0.009$
$p,\gamma_1(\theta)$ $\sim$isotropic for all E_p
$p,\gamma_2(\theta)$ $2^-, 5/2^+, 1/2^+$ or $2^-, 3/2^+, 1/2^+$ possible

C.A.Barnes, Phys. Rev. 97, 1226 (1955).

Levels $F^{19}(\alpha,\alpha'\gamma)$ $E_\alpha = 0.6$ to 2.8
$$\left.\begin{array}{ll} 0.109 & J = 1/2^- \\ 0.196 & J = 5/2^+ \end{array}\right\} \sigma(E);\ \alpha,\gamma(\theta)$$
Spin assignments consistent with $\sigma(E)$; $\alpha,\gamma(\theta)$; and τ_γ

R.Sherr, C.W.Li, R.F.Christy, Phys. Rev. 96, 1258 (1954); 94, 1076 (1954).

Levels $F^{19}(\alpha,\alpha'\gamma)$ $E_\alpha = 0.8$ to 2.0
γ 0.113 E1, E2 ? from γ yield
0.198* E2 from α yield/p yield

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 96, 426 (1954); *98, 1198A (1955).

$F^{19}(p,p'\gamma)$ $p,\gamma(\theta;H)$
$\mu(0.197\text{level}) \geq +4.0$ *9* KF solution

P.Lehmann, A.Lévêque, M.Fiehrer, Compt. rend. 241, 700 (1955).

γ $F^{19}(n,n'\gamma)$ $E_n = 0.1$ to 2.2
0.111 *1.5* γ scin
0.196 *2*
1.240 *15* Threshold$\sim$1.5
1.371 *16* Threshold = 1.62
Thresholds indicate levels at 1.43, 1.55

J.M.Freeman, Phys. Rev. 99, 1446 (1955).

$F^{19}(n,n'\gamma)$ $E_n = 4.5$ scin
γ 1.34 *3*
6.10 γ attributed to O^{16} production

G.L.Griffith, Phys. Rev. 98, 579 (1955).

$F^{19}(n,n'\gamma)$ $E_n \leq 1.8$ γ scin
γ 1.37 Threshold = 1.57

J.J.Van Loef, D.A.Lind, Phys. Rev. 98, 224A (1955).

F^{19}
9 10
stable

Level $O^{18}(d,n\gamma)$ scin ($4 < E_\gamma < 7.5$)
6.03*
Threshold for 6.03 and 4.37 γ's at $E_d = 0.350$
No γ to 0.197 level (< 5%)*

H.D.Holmgren, J.W.Butler, Phys. Rev. 99, 655A (1955); *verbal report.

Levels $O^{18}(p,\gamma)$* $E_p = 0.3$ to 2.6 scin

8.49	10.15
8.76	10.22
9.65	10.28
9.83	10.36
10.04	

*γ to g.s. or low lying levels

E.L.Hudspeth, I.L.Morgan, J.T.Peoples, Phys. Rev. 99, 643A (1955).

Levels $O^{18}(p,\gamma)$ $E_p = 0.3$ to 3.0 scin

Γ (kev)	Level	Γ (kev)	Level
2.6	8.553 *2*	< 15	9.551 *5*
40	8.759 *3*	4.0	9.631 *2*
< 0.9	9.068 *2*	1.5	9.784 *2*
< 15	9.280 *5*		

J.W.Butler, H.D.Holmgren, Phys. Rev. 99, 1649A (1955).

Levels $O^{18}(p,\alpha)$ $E_p = 0.7$ to 3.5 pc

8.749	
9.554	10.583
9.623	10.730
9.856	10.864
10.208	10.953
10.454	11.247

$O^{18}(p,n)$ $E_p = 2.6$ to 3.5 long counter

10.465	
10.585	11.067
10.835	11.165
10.951	11.255

H.A.Hill, J.M.Blair, Phys. Rev. 100, 961A (1955).

F^{20}
9 11
12^s

γ $F^{19}(d,p\gamma)$ $E_d = 1.05$ scin
1† (0.64)
2.5† (1.06)
$\sigma[F^{19}(d,p)] \gg \sigma[F^{19}(d,n+1.63\ \gamma)]$

L.C.Thompson, Phys. Rev. 96, 369 (1954).

Resonances $F^{19}(n)$ $E_n = 1$ to 160 kev

E_o (kev)	Level	J	l	Γ(kev)
27	6.626	1	1 or 2	~0.25
49.7	6.647	≥ 1	1 or 2	2.5
99.5	6.694	≥ 1	1 or 2	12.5

C.T.Hibdon, A.Langsdorf, Jr., Phys. Rev. 98, 223A (1955); verbal report.

F^{20}
9 11
12^s

Resonances $F^{19}(n)$ $E_n \leq 220$ kev Li(p,n)

E_o (kev)	Level	J
28	6.627	1,2
50	6.647	1, (2?)
99	6.694	1, (2?)

J.R.Patterson, H.W.Newson, E.Merzbacher, Phys. Rev. 99, 1625A (1955).

Capture γ F^{19}(th n,γ) sπ Cp
~20+ 6.63 *5*
+Photons/100 F captures

Geneva Conf. 8/P/651 (1955), L.V.Groshev et al. (USSR). See Appendix.

Levels $F^{19}(n,\alpha)7.4^sN^{16}$ $E_n = 3.5$ to 6.2

11.1†	10.56		
11.7†	11.05	11.9†	11.91
12.2†	11.39	11.4†	12.20
12.3†	11.73	10.6†	12.38

†σ in mb

N.A.Bostrom, E.L.Hudspeth, I.L.Morgan, Phys. Rev. 99, 643A (1955); verbal report.

F^{21}
9 12
5^s

Levels $F^{19}(t,p)$ $E_t = 1.82$ s 90°
g.s. Q = 6.269 *30*
0.33
1.11
1.84
2.16

N.Jarmie, Phys. Rev. 99, 1043 (1955).

Levels $F^{19}(t,p)$ $E_t = 0.9$ ppl 68°, 84°, 130°
g.s. Q = 6.03 *10*
0.89 *8*
3.34 *8* ?
4.01 *6* ?

C.B.Bigham, K.W.Allen, E.Almqvist, Phys. Rev. 99, 631A (1955).

Ne
10

Large variations for Ne^{21}/Ne^{20} and Ne^{22}/Ne^{20} in radioactive ores attributed to $O^{18}(\alpha,n)$ and $F^{19}(\alpha,n\beta^+)$

G.W.Wetherill, Phys. Rev. 96, 679 (1954).

Resonances Ne(n,n) $E_n = 0.8$ to 1.7 recoil pc

0.91 *1*	
1.31 *1*	1.62 *1*
1.38 *1*	1.68 *1*

H.O.Cohn, J.L.Fowler, Phys. Rev. 99, 1625A (1955).

Ne^{19}
10 9
18.5^{s}

β^+ ~100% (2.2) log ft = 3.3
Absence of low energy γ's shows log ft ≥ 6.0, ≥ 5.5 for transitions to 0.112, 0.200 F^{19} levels

G.A.Jones, W.R.Phillips, C.M.P.Johnson, D.H.Wilkinson, Phys. Rev. 96, 547 (1954).

β^+, F^{19} (θ) gives $G_S \simeq G_T$ assuming F^{19} configuration is $(d_{5/2})^3{}_{1/2}$
VTP interaction ruled out

D.R.Maxson, J.S.Allen, W.K.Jentschke, Phys. Rev. 97, 109 (1955).

Ne^{20}
10 10
stable

Levels $Ne^{(20)}(p,p')$ E_p = 9.5 ppl

g.s.	$\sigma(\theta)$ has a max. at 90°
1.58 *1*	σ symmetric about 90°
4.20 *1*	
4.95 *2*	
5.62 *2*	

R.G.Freemantle, D.J.Prowse, A.Hossain, J.Rotblat, Phys. Rev. 96, 1270 (1954).

γ $F^{19}(d,n)$ E_d = 3.6 sl pr

γ		
1.7*	9.38 *9*	No Doppler corrections
1.0*	10.01 *9*	
1.1*	10.65 *9*	
0.5*	11.56 *19*	

*Average σ in mb for E_d = 0 to 3.6

R.D.Bent, T.W.Bonner, J.H.McCrary, W.A. Ranken, R.F.Sippel, Phys. Rev. 99, 710 (1955).

Levels $F^{19}(d,n\gamma)$ $E_d \leq 2$ scin
11.69
11.37
From breaks in γ yield at E_d = 1.15, 1.35

J.W.Butler, Phys. Rev. 98, 241A (1955).

Levels $F^{19}(p,p)$ E_p = 0.5 to 2.1; s

Levels		
(13.438)	$\Gamma_p \ll \Gamma$	
(13.505)	$\Gamma_p \simeq \Gamma$	
(13.659)		
(13.700)	$\Gamma_p \ll \Gamma$	$l_p = 1$
(13.758)	$\Gamma_p \ll \Gamma$	
(14.157)		$l_p = 1$
(14.182)		$l_p = 1$
(14.230)		$l_p = 0$

From preliminary analysis of p,p(θ) at 4 angles

G.Dearnaley, Phil. Mag. 45, 1213 (1954).

Ne^{20}
10 10
stable

Levels $F^{19}(p,\gamma)$ E_p = 0.5 to 2.2 EA

E_o	Level	Γ(kev)
0.5968 *10*	13.437	30 *3*
0.6716 *7*	13.508	6.0 *7*
0.7803 *8*	13.611	7.6 *10*
0.8348 *9*	13.663	6.5 *10*
0.8745 *9*	13.700	5.4 *3*
0.9023 *9*	13.727	5.1 *10*
0.9351 *9*	13.758	8.6 *5*
1.090 *1.0*	13.905	0.7 *3*
1.123 *2.0*	13.937	22 *5*
1.140 *1.0*	13.953	2.5 *50*
1.189 *7.0*	14.000	110 *20*
1.283 *1.4*	14.089	18.6 *10*
1.348 *1.3*	14.151	5.6 *5*
1.375 *1.4*	14.176	11.0 *10*
1.607 *1.6*	14.397	6.0 *10*
1.694 *1.7*	14.479	35.0 *30*
1.949 *2.5*	14.722	40 *10*
2.030 *3.0*	14.799	120 *20*

S.E.Hunt, K.Firth, Phys. Rev. 99, 786 (1955).

Level $F^{19}(p,\gamma)$ E_p = 0.669 scin
(13.505) $\Gamma(13.505\gamma) < 0.02$ev
$(\sim 12\gamma)(1.63\gamma)(\theta)$ shows ~12γ mostly M1
J = 1^+, 2^+, 0^+

A.B.Clegg, G.A.Jones, D.H.Wilkinson, Proc. Phys. Soc. 68A, 538 (1955).

Levels $F^{19}(p,p)$ E_p = 0.55 to 1.8 sπ

E_0	Level	J	Γ_p/Γ*
(0.669)	(13.505)	1^+	0.916
(0.843)	(13.671)	0^+	0.996
(0.873)	(13.699)	2^- (1^-)	0.21
(0.935)	(13.758)	1^+	0.17
(1.346)	(14.149)	2^- (1^-)	0.067
(1.372)	(14.173)	2^-	0.17
(1.422)	(14.222)	1^+	0.85

Anomalies in σ_s identified with above levels
Other anomalies at 0.900, 1.092, 1.137?
*Using additional data for $\sigma(p,p')$ and $\sigma(p,\alpha)$

T.S.Webb, F.B.Hagedorn, W.A.Fowler, C.C. Lauritsen, Phys. Rev. 99, 138 (1955); E.U. Baranger, Phys. Rev. 99, 145 (1955).

Levels $F^{19}(p,p'\gamma)$ γ scin

E_o	Level	Γ(kev)	σ(mb) 0.109γ	σ(mb) 0.197γ
(0.669)	(13.505)	(7.5)	20	< 0.2*
(0.780)	(13.611)	~10	< 0.2*	~ 5
(0.831)	(13.659)	(8.3)	< 0.2*	~ 8
(0.845)	(13.673)	23	~ 2	< 0.3*
(0.873)	(13.699)	(5.2)	< 0.3*	90
(0.900)	(13.725)	(4.8)	< 0.3*	~20
(0.935)	(13.758)	(8.0)	150	<1*
(1.092)	(13.907)	(<1.2)	>13	>100
(1.137)	(13.950)	(3.7)	< 0.4*	~20
1.250	14.057	~80	17	1.7

(Continued)

Ne^{20}
10 10
stable

E_o	Level	Γ (kev)	σ (mb) 0.109γ	σ (mb) 0.197γ
(1.290)	(14.095)	(19)	< 1*	3
1.346	(14.149)	4.5	17	27
1.372	14.173	15	26	40
1.422	14.222	(15)	190	7
1.610	14.400	~5	12	< 2*
1.660	14.447		3	≤ 2*
1.700	14.485		36	17

*Upper limit of resonance portion

C.A.Barnes, Phys. Rev. 97, 1226 (1955).

Levels F^{19}(p, > 8-Mev γ) E_p = 0.55 to 1.45

scin(E_γ > 8)

E_o	Level	Yield*
0.669	13.505	160×10^{-4}
0.874	13.700	3
0.935	13.758	3
0.980	13.801	22
1.090	13.905	34
1.280	14.086	6
1.320	14.125	90
1.355	14.157	12
1.380	14.181	8
1.430	14.229	35

* > 8-Mev γ's/6-Mev γ's from O^{16}

G.K.Farney, H.H.Givin, B.D.Kern, T.M.Hahn, Phys. Rev. 97, 720 (1955).

Levels F^{19}(p,α) sT
F^{19}(p,p'γ) scin

E_o	Level	J*	σ(0.109γ)	σ(0.196γ)
0.873	13.70	2^-	< 1	~90
0.935	13.76	1^+	130	1.1
1.290	14.10	3^+		
1.355	14.16	2^-		
1.381	14.18	2^-	24	42**
1.431	14.23	1^+	187**	~7**
			mb	mb

*From p,α(θ) and p,p'(θ)
**From p,p' rather than p,p'γ

R.W.Peterson, W.A.Fowler, C.C.Lauritsen, Phys. Rev. 96, 1250, 851A (1954).

Ne^{21}
10 11
stable

Levels Ne^{20}(d,p) E_d = 0.855
50+ g.s. Q = 4.526 *9* s 91°, 135°
50+ 0.349 *6*
100+ 2.788 *6*
No level between 1.5 and 1.9 (< 2+)

K.Ahnlund, Arkiv Fysik 9, 39 (1955); 7, 155 (1954).

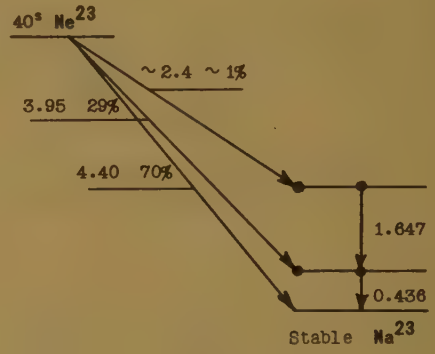
Ne^{22}
10 12
stable

γ F^{19}(α,pγ) E_α = 5.3
st 1.28 scin
1.51

R.J.Breen, M.R.Hertz, Phys. Rev. 98, 599 (1955).

Ne^{23}
10 13
40^s

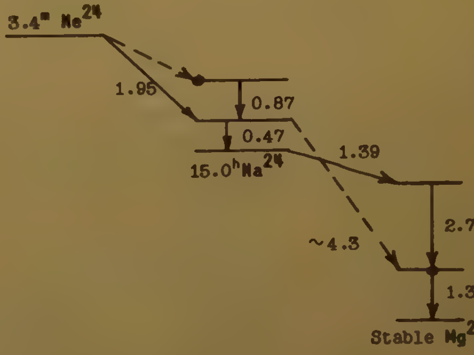
β^- ~ 1% ~2.4 Na^{23}(d, 2p) chem
~29% 3.95 *5* scin
~70% 4.40 *5*
γ 29+ 0.436 scin
1.2+ 1.647
(~2.4β)(1.65γ) (3.95β)(0.436γ) scin
(0.436γ)(1.65γ)



J.R.Penning, F.H.Schmidt, Phys. Rev. 100, 954A (1955).

Ne^{24}
10 14
3.4^m

τ 3.4^m *1* $Ne^{(22)}$(1.8-Mev t,p)
β^- st 1.95 scin
w ~4.3 in Na^{24} daughter ?
γ 10^+ 0.471 *5* scin
1^+ 0.875 *10*
β(0.875γ) No (0.471γ)(β or γ)
D $15.0^h Na^{24}$



B.J.Dropesky, A.W.Schardt, Phys. Rev. 100, 954A (1955).

Na^{21}
11 10
23^{s}

Levels $\mathrm{Ne}^{(20)}(p,p)$ $E_p = 0.2$ to 4.4

Level	Γ(kev)	J	
4.18	180	3/2−	pc
4.31	6	5/2+	
4.49	17	3/2+	
5.48	110	1/2+	
5.85	25	3/2−	
6.10	6	5/2−,7/2−	
6.53	150	3/2+,5/2+	

For all levels except 6.10 $\Gamma_{el} > 0.7\,\Gamma$

Additional resonances at $E_p = 2.7$(double ?), 3.42($\Gamma \sim 20$ kev), and 3.552($\Gamma \sim 2$ kev)

W.Haeberli, Phys. Rev. 99, 640A (1955); W.Haeberli, A.Galonsky, E.Goldberg, R.Douglas, Phys. Rev. 91, 438A (1953).

Na^{22}
11 11
2.6^{y}

ε 11.0 ± 0.9% $\gamma^{\pm}/1.28\,\gamma$ scin

W.E.Kreger, Phys. Rev. 96, 1554, 854A (1954).

$\mathrm{Mg}^{(24)}$(19-Mev d,α) chem

$\epsilon/\beta^{+} = 0.122$ *10* $\beta^{+}/\mathrm{Ne}^{22}$ atoms

Ne^{22} atoms measured by gas collection

β^{+} emission rate measured by 4π GM, scin

R.A.Allen, W.E.Burcham, K.F.Chackett, G.L.Munday, P.Reasbeck, Proc. Phys. Soc. 68A, 681 (1955).

$\epsilon/\beta^{+} = 0.065$ *9* e_A/β^{+} a, 4π GM

Author concludes results with e_A not too reliable due to self-absorption and detection uncertainty

G.Charpak, J. phys. radium 16, 62 (1955).

γ (1.28) $\alpha = 6.7 \pm 0.7 \times 10^{-6*}$ s

*From comparison with α for 1.33 γ from Co^{60}.

R.D.Leamer, G.W.Hinman, Phys. Rev. 96, 1607 (1954); 90, 370A (1953).

Levels $\mathrm{F}^{19}(\alpha,n)$ $E_\alpha = 8$

g.s	Q = −2.0	pc, n thresh
0.4		
1.1		
2.2		

W.T.Doyle, A.R.Quinton, Phys. Rev. 97, 252A (1955).

Levels $\mathrm{Mg}^{(24)}(d,\alpha)$ $E_d = 5$ to 7

g.s.	Q = 1.953 *12** 30°,90° s
0.59	
0.89	2.22 ?
1.53	2.58
1.94	2.98
1.99	3.07

Yield of α's to g.s. and 0.59 level about equal

C.P.Browne, W.C.Cobb, Phys. Rev. 99, 644A (1955); *verbal report.

$_{11}\mathrm{Na}^{22}_{11}$
2.6^{y}

Levels $\mathrm{Ne}^{(20)}(d,p)$ $E_d = 0.8$ to 1.1; pc

12.07 p's to Ne^{21} 0.35 level

12.13 p's to Ne^{21} 1.73 level

No p's to Ne^{21} 2.84 level

S.Gorodetzky, T.Muller, M.Port, Compt. rend. 240, 1704, 2224 (1955).

Na^{23}
11 12
stable

μ +2.216124 I

$\nu(\mathrm{Na}^{23})/\nu(\mathrm{H}^{2}) = 1.723167$ *34*

H.E.Walchli, ORNL-1775 (1954).

Q +0.100 *11* (or −0.836 *28*) M

M.L.Perl, I.I.Rabi, B.Senitzky, Phys. Rev. 98, 611; 97, 838 (1955).

Level $\mathrm{Na}^{23}(\alpha,\alpha'\gamma)$ $E_\alpha = 1.5$ to 3.7

γ 0.446 $\epsilon B(2) = 0.041$ scin

E2 from α yield/p yield

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 96, 426 (1954); 95, 629A (1954); 98, 1198A (1955).

Levels $\mathrm{F}^{19}(\alpha,\alpha' + 0.109\,\gamma)$ scin

$E_\alpha = 0.6$ to 2.8

1†	12.17	6†	12.53
2†	12.24	300†	12.59
4†	12.32	450†	12.69
6†	12.36	2.5†	12.75
5†	12.43	60†	12.78
1.4†	12.47		

$\mathrm{F}^{19}(\alpha,\alpha' + 0.196\,\gamma)$

10†	12.36?	160†	12.69
20†	12.53		12.75?
40†	12.59	470†	12.78

$\mathrm{F}^{19}(\alpha,p + 1.28\,\gamma)$

7.9†	11.59	380†	12.24
12.8†	11.63	1200†	12.32
13.8†	11.66		12.36?
34.5†	11.70	320†	12.40
22.5†	11.74		12.43?
24.5†	11.87	800†	12.47
314†	12.05	370†	12.50
81.7†	12.08	3400†	12.53
60.7†	12.11	4600†	12.59
60.6†	12.15	2400†	12.69
173†	12.17		12.75?
42†	12.22	5500†	12.78

†peak γ yields/10^{12} α's

R.Sherr, C.W.Li, R.F.Christy, Phys. Rev. 96, 1258 (1954).

Na^{24}
11 13
15^{h}

τ 14.90^{h} *5* differential ic

J.Tobailem, J. phys. radium 16, 48 (1955).

Na^{24}
11 13
15^h

Capture γ's	Na^{23}(th n,γ)		sπ Cp
74+	0.47 *2*	5+	3.30 *2*
5+	0.71 *2* ?	18+ {	3.56 *3*
4.3+	0.79 *2*		3.60 *3*
44+	0.86 *1*	1.3+	3.68 *5* ?
6.5+	1.35 *1*	5.9+	3.86 *4*
7.5+	1.66 *1*	17.2+	3.98 *4*
5.5+	1.87 *3*?	2.1+	4.18 *4*
4+	1.95 *3*?	0.5+	4.30 *5* ?
11.5+	2.02 *2*	2.1+	4.50 *4*
7.5+	2.21 *3*	0.9+	4.70 *5* ?
10.5+	2.41 *3*	1.2+	4.90 *5* ?
21+	2.52 *2*	0.8+	5.12 *5* ?
8.5+	2.68 *2*	0.3+	5.30 *5* ?
7+	2.84 *2*	6+	5.61 *3*
9.5+	3.08 *2*	22+	6.40 *3*

No 0.56γ (< 3+)
+Photons/100 Na captures
Some weak lines may belong to F^{20}

Geneva Conf. 8/P/651 (1955), L.V.Groshev, et al. (USSR). See Appendix.

Resonances	Na^{23}(n)		Li(p,n)
	0.003	complex ?	$l = 1$?
	0.050		$l = 1$?

A.L.Toller, H.W.Newson, E.Merzbacher, Phys. Rev. 99, 1625A (1955).

Ne$^{(22)}$(d,γ) E$_d$ = 1.6
$\sigma < 4 \times 10^{-7}$ 15^{h}Na^{24}

H.R.Allan, N.Sarma, Proc. Phys. Soc. 68A, 535 (1955).

Na^{25}
11 14
62^s

τ	60^s *2*	Mg(~16-Mev n)	
γ	0.41 *1*	0.59 *1*	scin
	0.46 *1*	0.98 *1*	

No γ with E$_\gamma$ ~0.10 to 0.12

J.E.Iwersen, W.S.Koski, Phys. Rev. 98, 1307 (1955).

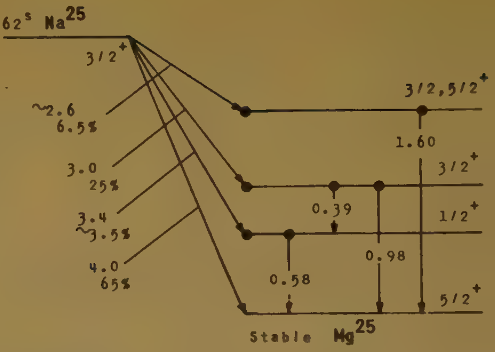
Mg$^{(26)}$($\leq$ 30-Mev γ,p)

β^-	6.5%	~2.6	scin $\beta\gamma$
	25%	(3.0)	
	~3.5%	(3.4)	
	65%	4.0 *2*	scin
γ	10+	0.384 *10*	scin
	13+	0.576 *10*	
	23+	0.978 *15*	
	9+	1.603 *20*	

(~3.2β)(0.38γ, 0.58γ, 0.98γ)
(~2.6β)(1.60γ)

(Continued)

Na^{25}
11 14
62^s



D.Maeder, P.Staehelin, Helv. Phys. Acta 28. 193 (1955).

Mg
12

γ	Mg(n,n'γ)		E$_n$ = 3.2	scin
	0.38	st	1.30	
	0.59		1.79	

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Level	Mg(n,n'γ)	E$_n$ ~2.7	
γ	0.438	1.34	scin
	0.555	1.91	
	0.688	2.08	
	0.837	2.44	
	1.00		

L.A.Rayburn, D.L.Lafferty, T.M.Hahn, Phys. Rev. 98, 701 (1955); 95, 637A (1954).

Levels	Mg(n,n')	E$_n$ = 2.5
	0.80 *12*	pc
	1.29 *12*	
	1.55 *12*	

Geneva Conf. 8/P/714 (1955), M.V.Pasechnik (USSR).

Mg^{22}?
12 10

τ 0.13^s Mg(23-Mev p)
See also Al^{23}

H.Tyrén, P. A.Tove, Phys. Rev. 96, 773(1954).

Mg^{24}
12 12
stable

Levels	Mg$^{(24)}$(p,p')	E$_p$ = 3.0 to 6.5
	Mg$^{(24)}$(d,d')	E$_d$ = 4.0 to 7.8
	g.s.	a
	1.37 *4*	

Graph of σ(E, 70°) given

G.W.Greenlees, Proc. Phys. Soc. 68A, 97 (1955).

Mg^{24}
12 12
stable

Levels $\mathrm{Al}^{27}(p,\alpha)$ $E_p = 6.5$ ppl

0.16†	g.s. Q = 1.61 *4*
0.61†	1.38
0.15†	4.18 doublet not resolved

†$d\sigma/d\omega$ at 90°

G.W.Greenlees, Proc. Phys. Soc. 67A, 1107 (1954).

Levels $\mathrm{Mg}^{(24)}(p,p')$ $E_p = 9.9$

g.s.	p, p(θ)*
(1.37)	p, p'(θ)**
~4.2	90°
5.1 *1* } Mg^{24}?	
5.9 *1* }	
6.3 *1* }	pc, scin

*Diffraction effects observed

**Analyzed for direct collision and compound nucleus formation

G.E.Fischer, Phys. Rev. 96, 704 (1954).

$\mathrm{Na}^{23}(p,\gamma)$ scin, 90°

4.24 level $J = 2^+$

$(8.03\gamma)(4.24\gamma)(\theta)$ $J = 2, 2, 0$
$(8.11\gamma)(4.24\gamma)(\theta)$ $J = 3, 2, 0$

12.00 level $E_p = 0.310$ $J = 2^-$

$\Gamma(6.74\gamma) = 0.015$
$\Gamma(7.76\gamma) = 0.066$
$\Gamma(10.6\gamma) = 0.044$
p, (1.38, 2.86, 3.88, 4.24, 6.74, 7.76, 10.6 γ's)(θ)
$(10.6\gamma)(1.38\gamma)(\theta)$ $J = 2, 2, 0$

12.20 level $E_p = 0.515$ $J = 1^+$

$\Gamma(6.94\gamma) = 0.011$
$\Gamma(7.96\gamma) = 0.022$
$\Gamma(10.8\gamma) = 0.089$

p, (1.38, 7.96, 10.8 γ's)(θ)
$(10.8\gamma)(1.38\gamma)(\theta)$ $J = 1, 2, 0$

12.27 level $E_p = 0.593$ $J = 2^{-*}$

$\Gamma(7.01\gamma) = 0.016$
$\Gamma(8.03\gamma) = 0.051$
$\Gamma(10.9\gamma) = 0.027$
p, (1.38, 2.86, 3.88, 4.24, 7.01, 8.06, 10.9 γ's)(θ)
$(10.9\gamma)(1.38\gamma)(\theta)$ $J = 2, 2, 0$
$(8.03\gamma)(4.24\gamma)(\theta)$ $J = 2, 2, 0$

12.35 level $E_p = 0.679$ $J = 3^+$

$\Gamma(7.09\gamma) = 0.063$
$\Gamma(8.11\gamma) = 0.13$
$\Gamma(11.0\gamma) = 0.033$
p, (1.38, 4.24, 7.09, 8.11, 11.0 γ's)(θ)
$(11.0\gamma)(1.38\gamma)(\theta)$ $J = 2, 2, 0$
$(8.11\gamma)(4.24\gamma)(\theta)$ $J = 3, 2, 0$

* 0.593 resonance with $J = 2^-$ is distinct from that in $\mathrm{Na}^{23}(p,\alpha)$ at this energy ($\Delta E_p < 0.002$)

P.J.Grant, J.G.Rutherglen, F.C.Flack, G.W. Hutchinson, Proc. Phys. Soc. 68A, 369 (1955).

Mg^{24}
12 12
stable

Level $\mathrm{Na}^{23}(p,\gamma)$

11.99 level $E_p = 0.31$

γ	11†	1.38 *2*		scin
	6†	4.11 *5*	double ?	scin pr
	1.3†	6.7 *2*		
	8†	7.7 *1*		
	7†	10.6 *2*		

No 2.76 γ

B.Hird, C.Whitehead, J.Butler, C.H.Collie, Phys. Rev. 96, 702 (1954).

Levels $\mathrm{Na}^{23}(p,\gamma)$ scin
$\mathrm{Na}^{23}(p,\alpha)$ s

11.98 level $E_p = 0.287$

$Y_\alpha = 0.2$ $Y_\gamma < 0.05$

12.00 level $E_p = 0.310$

γ	18†	1.38	3.5†	6.75
	4.4†	2.88	15†	7.75
	2.7†	4.0	10†	10.5
	13†	4.24		

$Y_\alpha < 0.2$ $Y_\gamma = 0.37$

12.03 level $E_p = 0.338$

$Y_\alpha = 0.17$ $Y_\gamma < 0.01$

12.20 level $E_p = 0.515$

γ	12†	1.39	1.2†	7.1
	0.6†	2.86	2.4†	8.1
	1.5†	4.23	10†	10.8

$Y_\alpha < 0.04$ $Y_\gamma = 0.16$

12.27 level $E_p = 0.593$

γ	20†	1.38	12.7†	4.24
	8†	1.64*	6.1†	7.01
	10†	2.86	19†	8.09
	3†	3.93	10†	10.8

*Assigned to Ne^{20} $Y_\alpha = 84$ $Y_\gamma = 0.35$

12.35 level $E_p = 0.679$

γ	32†	1.38	7†	5.5
		1.6*	19†	7.09
	14†	2.84	39†	8.15
	10†	3.91	10†	10.9
	28†	4.23		

*Assigned to Ne^{20} $Y_\alpha < 0.13$ $Y_\gamma = 1.09$

$Y_\alpha, Y_\gamma = \alpha, \gamma$ reaction yield per 10^{10} protons
$(\sim 10.6\ \gamma)(1.38\ \gamma)$ $(\sim 8.0\ \gamma)(4.24\ \gamma, \sim 2.8\ \gamma)$
$(1.38\ \gamma)(\sim 7.0\ \gamma, \sim 8.0\ \gamma)$

F.C.Flack, J.G.Rutherglen, P.J.Grant, Proc. Phys. Soc. 67A, 973 (1954).

Levels $\mathrm{Na}^{23}(p,\gamma)$ $E_p = 0.5$ to 1.0

		E_0	
10†	12.194	0.5120	*20*
30†	12.210	0.5923	*20*
100†	12.367	0.6770	*20*
45†	12.415	0.7430	*20*
90†	12.540	0.8737*	*20*

*Not $\mathrm{F}^{19}(p,\alpha\gamma)$ resonance ($< 2 \times 10^{-4}$% F present)

K.Nybø, T.Grotdal, Nature 175, 130 (1955).

Mg^{24} Levels Na^{23}(p, >8-Mev γ)
12 12
stable
12.276 E$_p$ = 0.55 to 1.45
12.681 scin(E$_\gamma$ > 8)
12.830
12.863

G.K.Farney, H.H.Givin, B.D.Kern, T.M.Hahn, Phys. Rev. 97, 720 (1955).

Levels Na^{23}(p,α_0) E$_p$ = 1.0 to 1.9

	J	pc
12.673	3-	p $\alpha(\theta)$
12.751		
12.793	0+	
12.821	2+	
12.936		
13.43 double ?		

P.H.Stelson, Phys. Rev. 96, 1584 (1954).

Mg^{25} Mg^{25}(p,p'γ) E$_p$ = 1.90 to 2.98
12 13
stable
γ 106+ 0.40 1.61
0.58 1.96
100+ 0.98 2.56
(0.40γ)(0.58γ)

H.E.Gove, A.E.Litherland, E.B.Paul, G.A. Bartholomew, Phys. Rev. 99, 1649A (1955).

Mg^{26} γ Na^{23}(α, pγ) E$_\alpha$ = 5.3
12 14
stable
0.43* scin
1.13
st 1.83
st 2.57
*May be due to Na^{23}(α,α'γ)

R.J.Breen, M.R.Hertz, Phys. Rev. 98, 599 (1955).

Al^{23}? τ 0.13^s Mg(23-Mev p)
13 10
See also Mg^{22}

H.Tyrén, P.A.Tove, Phys. Rev. 96, 773(1954).

Al^{24} τ 2.10^s *4* Mg$^{(24)}$(20-Mev p,n)
13 11
2.1^s
α (~10^{-2}%) ~2 scin
β^+ w ~8.5 scin
γ 40+ 1.39 *3* scin
32+ 2.73 *6*
15+ 4.22 *10*
6+ 5.35 *10*
7+ 7.12 *10*

N.W.Glass, J.R.Richardson, Phys. Rev. 98, 1251 (1955).

Al^{25} τ 7.2^s Mg^{24}(825-kev p,γ)
13 12
7.6^s

D.W.Green, J.C.Harris, J.N.Cooper, Phys. Rev. 96, 817A (1954).

Al^{25} β^+ 1000+ (3.24) Mg$^{(25)}$(6.7-Mev p,n)
13 12
7.6^s
γ < 3+ 0.98 ? scin
>0.4+, < 3+ 1.58 *3*
No 0.58γ (< 30+)

D.Maeder, P.Staehelin, Helv. Phys. Acta 28, 193 (1955).

Mg$^{(24)}$(0.225-Mev p,γ)
β^+ 3.24 *3* F-K linear(E$_\beta$>1.3) sl
No γ scin

B.Elbek, B.S.Madsen, Phil. Mag. 46, 663 (1955).

Levels Mg$^{(24)}$(p, γ) E$_p$ = 0.418, 2.40

	J	
(0.95)	3/2	p, $\gamma(\theta)$
(2.70)	3/2	
(3.88)	5/2	
(4.22)	3/2	
(4.60)	5/2	

G.A.Bartholomew, H.E.Gove, A.E.Litherland, E.B.Paul, Phys. Rev. 99, 1649A (1955).

Levels Mg^{24}(p,γ) E$_p$ = 0.2 to 0.7

Level	E$_0$	
2.51	0.224 *15*	scin
2.69	0.421 *15*	

J.C.Kluyver, C. Van der Leun, P.M.Endt, Physica 20, 1287 (1954).

Levels Mg^{24}(p,γ) E$_p$ = 0.8 to 2.1

	J	Γ_γ(ev)	p,$\gamma(\theta)$
(3.09)	3/2-	0.16	scin
(3.72)*	7/2-	0.008	
(3.85)	1/2-	0.298	
(3.88)	5/2+	0.03	
(4.22)	3/2+	~40	

*Observed 0.85, 0.95, 1.34, 1.91, 3.72 γ's

E.B.Paul, G.A.Bartholomew. H.E.Gove, A.E. Litherland, Phys. Rev. 99, 644A (1955); verbal report.

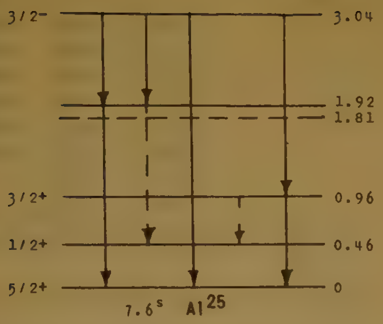
Capture γ's Mg^{24}(p,γ) E$_p$ = 0.825; γ scin
3.04 level J = 3/2- Γ_γ = 0.08 ev

158+	0.460 *10*	19+	2.11 *3*
11+	0.96 *2*	159+	2.59 *3*
2+	1.12 *2*	27+	3.04 *3*

No evidence for 1.81 level
Spin assignments from p,$\gamma(\theta)$

(Continued)

Al^{25}
13 12
7.6^s



L.L.Green, J.J.Singh, J.C.Willmott, Phil. Mag. 46, 982 (1955).

Al^{26}
13 13
6.7^s

τ 6.4^s Mg^{25}(563,720-kev p,γ)

D.W.Green, J.C.Harris, J.N.Cooper, Phys. Rev. 96, 817A (1954).

β^+ 3.20 *5* sl

R.W.Kavanagh, W.R.Mills, R.Sherr, Phys. Rev. 97, 248 (1955); Phys. Rev. 98, 1185A (1955).

Mg^{25}(0.391-Mev p,γ)
β^+ 3.21 *3* F-K linear(E_β>1.3) sl
No γ scin

B.Elbek, B.S.Madsen, Phil. Mag. 46, 663 (1955).

Al^{26}
13 13
$\sim 10^{6y}$
g.s.

τ $\sim 10^{6y}$ Mg(15-Mev d) chem
β^+? ~1 a
γ 0.5 (annihilation?) scin
1.9

J.R.Simanton, R.A.Rightmire, A.L.Long, T.P.Kohman, Phys. Rev. 96, 1711 (1954); 98, 260 (1955).

Al^{27}(22-Mev p) chem
β^+ 100+ 1.30 *15* a
γ 1+ 0.717 scin
100+ 1.82 ic scin
0.4+ 2.91 scin
(1.82γ) $\gamma^{\pm}$ scin

T.H.Handley, W.S.Lyon, Phys. Rev. 99, 755 (1955).

Levels Na^{23}(α,n)

g.s.	Q = −2.9		pc
0.3*		1.9	n thresh
1.0		2.5	
1.4		3.0	

*$\gamma^{\pm}$ first appears at Q = −3.2 scin

W.T.Doyle, A.B.Robbins, Phys. Rev. 98, 1185A (1955); verbal report.

Al^{26}
13 13
$\sim 10^{6y}$

Capture γ's Mg^{25}(p,γ) E_p = 0.3 to 0.7

6.62 level E_o = 0.321 *15* Γ_γ(2J+1) = 0.3ev

27†	0.420 *5*		3.40 *6* ?	scin
6†	0.836 *20*	18†	4.82 *4*	
	1.34 *3*	18†	6.22 *5*	
	2.68 *6*	7†	$\gamma^{\pm}$	

6.69 level E_o = 0.395 *15* Γ_γ(2J+1) = 0.6ev

17†	0.421 *5*		2.78 *5*
9†	0.829 *8*		3.48 *8*
4†	1.002 *15*	18†	4.61 *7*
	1.34 *3*	4†	6.21 *6*
	1.68 *6*	≤12†	$\gamma^{\pm}$
	2.06 *6*		

6.73 level E_o = 0.441 *15* Γ_γ = 0.08ev J = 4−

19†	0.415 *5*	8†	4.70 *10*
	1.33 *2*	6†	6.28 *12*
	1.84 *4*	25†	6.77 *8*
	2.35 *7* ?	≤21†	$\gamma^{\pm}$
	3.82 *6*		

E_o = 0.501 *15* Not resolved
E_o = 0.518 *15* Γ_γ(2J + 1) = 0.8ev

41†	0.419 *5*	10†	4.22 *6*
7†	0.817 *8*	12†	4.72 *4*
3†	0.999 *15*	4†	5.04 *7*
	1.34 *3*	10†	6.36 *5*
	2.36 *6*	≤37†	$\gamma^{\pm}$
	2.72 *8*		

6.85 level E_o = 0.580 *15* Γ_γ(2J + 1) = 1.5ev

25†	0.423 *7*	22†	4.27 *4*
9†	0.820 *4*	~7†	4.92 *8*
4†	1.011 *15*	~3†	5.82 *10*
	1.34 *2*	18†	6.44 *4*
	1.87 *6*	~3†	6.80 *8*
	2.41 *7* ?	25†	$\gamma^{\pm}$
	2.85 *5*		

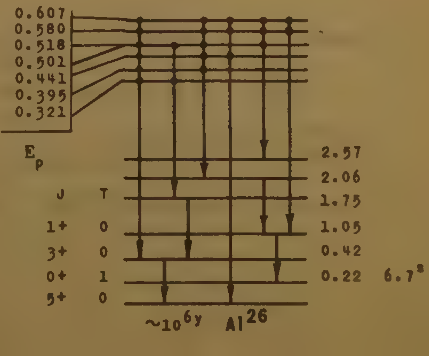
6.89 level E_o = 0.607 *15* Γ_γ(2J + 1) = 1.1ev

27†	0.412 *7*		2.94 *6*
10†	0.823 *8*	25†	4.34 *5*
6†	0.995 *15*	~7†	4.84 *8*
	1.35 *3*	~3†	5.79 *10*
	1.63 *3*	19†	6.47 *5*
	1.87 *4*	~3†	6.81 *10*
	2.05 *6*	27†	$\gamma^{\pm}$
	2.25 *4*		

6.95 level E_o = 0.667 *15* Γ_γ(2J + 1) = 0.3ev
6.97 level E_o = 0.688 *15* Γ_γ(2J + 1) = 1.6ev

†Intensity as % of all γ's with E_γ > 1

J.C.Kluyver, C.Van der Leun, P.M.Endt, Physica 20, 1287 (1954); Phys. Rev. 94, 1795 (1954).



Al^{26}
13 13
$\sim 10^{6}$ y

Capture γ's $Mg^{25}(p,\gamma)$ scin

6.98 level		$E_0 = 0.697$	
		0.416	

7.01 level		$E_0 = 0.730$	high $\gamma^{\pm}$ yield
		0.416	1.44 *3*
	3†	0.833 6*	2.46 *3*
	2†	1.022 6*	5.00 5*

7.20 level		$E_0 = 0.933$	high $\gamma^{\pm}$ yield
		0.833	1.022

7.23 level		$E_0 = 0.958$		low $\gamma^{\pm}$ yield
	2†	0.416 4*	1†	2.08 2**
	2†	1.67 2*		5

$E_0 = 0.990$ $E_0 = 1.046$ $E_0 = 1.086$	high $\gamma^{\pm}$ yield
0.416	1.022
0.833	

*In prompt coincidence (delay < 4 μs)
**Not in coincidence with 0.416 γ

R.W.Kavanagh, W.R.Mills, R.Sherr, Phys. Rev. 97, 248 (1955); Phys. Rev. 98, 1185A (1955).

Resonances $Mg^{25}(p,\gamma)$

E_0	γ yield	β^{+} yield
0.3167 *7*	70	100
0.3915 *5*	140	400
0.4365 *4*	200	< 20*
0.4956 *6*	180	350
0.5134 *7*	155	320
0.5304 *7*	92	220

*Suggests 0.4365 resonance de-excites preferentially to long-lived Al^{26} g.s.

S.E.Hunt, D.A.Hancock, Phys. Rev. 97, 567 (1955).

Al^{27}
13 14
stable

μ +3.638360 I
$\nu(Al^{27})/\nu(Na^{23}) = 0.985055$ *12*

H.E.Walchli, ORNL-1775 (1954).

Levels $Al^{27}(D,D')$ $E_p = 4.9$ DPl

62†	g.s.	1.2†	2.22
0.56†	0.83 *10*	0.84†	3.01
1.4†	1.01		

†dσ/dω in mb/sterad at 45°
Possible level between 2.2 and 3.0

K.B.Mather, Australian J. Phys. 7, 658 (1954).

Al^{27}
13 14
stable

Levels $Al^{27}(D,D')$ $E_p = 5.64$ to 8.45 sπ 90°

0.842	4.054	5.425
1.013	4.403	5.491
2.213	4.505	5.544
2.732	4.576	5.659
2.977	4.807	5.821
3.001	5.150	5.951 ?
3.677	5.242	
3.954	5.410	

No 5.00 or 5.11 level (peaks due to C^{12})
No other level below 5.3 (yield < 5% of 0.842 level)
All values ± 0.006 Resolution 0.015

C.P.Browne, S.F.Zimmerman, W.W.Buechner, Phys. Rev. 96, 725 (1954).

Levels $Al^{27}(n,n')$ $E_n = 2.5$ pc

1.00 *12*
1.36 *12*
1.60 *12*

Geneva Conf. 8/P/714 (1955), M.V.Pasechnik (USSR).

Levels $Al^{27}(n,n')$ $E_n = 15.4$; 90° scin

3.0 *12*
4.0 *11*
5.8 *10*
8.1 *7*

R.Ramanna, N.Veeraraghavan, P.K.Iyengar, Nuovo Cim. 1, 623 (1955)..

γ $Al^{27}(n,n'\gamma)$ $E_n \sim 2.7$ scin

0.422	1.69
0.843	2.10
0.988	

L.A.Rayburn, D.L.Lafferty, T.M.Hahn, Phys. Rev. 98, 701 (1955); 95, 637A (1954).

γ $Al^{27}(n,n'\gamma)$ $E_n = 3.2$ scin

0.05	1.20
0.89	1.70
1.05	2.2

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

γ $Al^{27}(n,n'\gamma)$ $E_n = 4.5$ scin

0.84 *2*
1.02 *3*
2.27 *6*
3.10 *8*

G.L.Griffith, Phys. Rev. 98, 579 (1955).

Al^{27}
13 14
stable

Levels $Mg^{26}(p,\gamma)$ E_p = 0.3 to 0.7

Level		E_0	
8.550	w	0.300 *15*	scin
8.588		0.340 *15*	
8.702		0.458 *15*	

J.C.Kluyver, C.Van der Leun, P.M.Endt, Physica 20, 1287 (1954).

Levels $Mg^{26}(p,\gamma)$

Level	E_0
8.587	0.3385 *5*
8.698	0.4542 *3*

S.E.Hunt, D.A.Hancock, Phys. Rev. 97, 567 (1955).

Levels $Na^{23}(\alpha,p+1.83\gamma)$ E_α = 1.8 to 3.7

11.77	12.69	scin
11.93	12.72	
12.08	12.79	
12.24	12.85	
12.28	12.90	
12.35	13.00	
12.49	13.08	
12.57	13.15	

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 96, 426 (1954).

Al^{28}
13 15
2.3^m

Resonances $Al^{27}(n)$ Li(p,n)

0.035	l = 0 ?	Γ = 0.0012
0.090	l = 0 ?	Γ = 0.007

Other resonances with higher energies

A.L.Toller, H.W.Newson, E.Merzbacher, Phys. Rev. 99, 1625A (1955).

Al^{29}
13 16
6.6^m

γ	89%	1.28	$Si^{(29)}(n,p)$;	scin
	9%	2.43		

No 2.03 γ (< 4%)
No 1.15 γ (< 11%) No $\gamma\gamma$ $\gamma\gamma$ scin

H.Roderick, O.Lönsjö, W.E.Meyerhof, Phys. Rev. 97, 97 (1955); 90, 371A (1953).

Si^{26}?
14 12

τ 1.7^s Al^{27}(23-Mev p)

H.Tyrén, P.A.Tove, Phys. Rev. 96, 773(1954).

Si^{28}
14 14
stable

Level $Si^{28}(p,p'\gamma)$ E_p = 3.1
γ 1.76 *2* scin

H.O.Cohn, J.K.Bair, J.D.Kington, H.B.Willard, Phys. Rev. 99, 644A (1955); verbal report.

Si^{28}
14 14
stable

Levels $Al^{27}(d,n)$ E_d = 2.17
ppl 0°, 90°

1.76 *10**	
4.37 *15*	
4.79 *15*	8.49 *6*
6.26 *6*	9.25 *12*
6.83 *6*	9.86 *8*
7.32 *10*	10.09 *12*?
7.89 *8*	10.65 *8*

g.s. group not observed (< 10% at 0° and < 20% at 90° of 1.76 level group)
*Measured value; 1.78 assumed for calculations

A.Rubin, F.Ajzenberg, H.Mark, Phys. Rev. 100, 961A (1955).

Capture γ's $Al^{27}(p,\gamma)$ E_p = 0.986
$D(\gamma,p)$ ppl

st	4.5
st	5.1
st	5.7
w	6.7
w	7.5
w	8.3
st	10.7
w	12.1

M.Hattori, K.Hisatake, T.Mikumo, T.Momota, J. Phys. Soc. Japan 10, 242 (1955).

Si^{29}
14 15
stable

Levels $Si^{(28)}(d,p\gamma)$ E_d = 2.8 scin

γ	6†	1.28	2†	3.07
	4†	2.03	10†	4.93
	1†	2.43	4†	6.38

H.Roderick, O.Lönsjö, W.E.Meyerhof, Phys. Rev. 97, 97 (1955).

Levels $Si^{28}(d,p\gamma)$ E_d = 1.35 scin

γ	1.25	3.08
	2.04	~4.9

L.C.Thompson, Phys. Rev. 96, 369 (1954).

Si^{30}
14 16
stable

γ $Al^{27}(\alpha,p\gamma)$ E_α = 5.3
scin
1.25
2.28
3.55

R.J.Breen, M.R.Hertz, Phys. Rev. 98, 599 (1955).

P^{28}
15 13
0.28^s

τ		0.280^s *10*	$Si^{(28)}$(20-Mev p,n)
β^+	~50%	10.6 *4*	scin
	~50%	others (E_β < 9)	
γ	75+	1.79 *2*	scin
		2.6 *2* ?	
	10+	4.44 *5*	
		4.93 *8* ?	
	10+	6.14 *10* 6.70 *12* 7.04 *10*	
	5+	7.59 *15*	

No α (< 3×10^{-3}% if E_α > 0.75)

N.W.Glass, J.R.Richardson, Phys. Rev. 98, 1251 (1955).

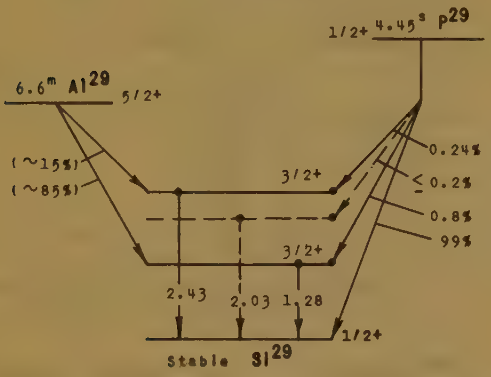
P^{28}
15 13
0.28^{s}

τ 0.27^{s} Si(20-Mev p)

H.Tyrén, P.A.Tove, Phys. Rev. 96, 773 (1954).

P^{29}
15 14
4.45^{s}

τ 4.45^{s} *5* $Si^{(28)}$(2.8-Mev d,n)
β^{+} 98.8% 3.945 *5* sl
γ 0.8% 1.28 $\gamma^{\pm}\gamma/\gamma^{\pm}$, scin
$\leq$0.15% 2.03 ?
0.2 to 0.5% 2.43
(1.28γ, 2.03γ?, 2.43γ)$\gamma^{\pm}$
No higher energy γ's detected



H.Roderick, O.Lönsjö, W.E.Meyerhof, Phys.Rev. 97, 97 (1955); 90, 371A (1953).

Levels Si^{28}(p,p' + 1.78γ) E_p = 3 to 5
5.72 6.82 0°, scin
5.95 7.01 (double?)
6.18 7.25
6.31 7.44

H.O.Cohn, J.K.Bair, J.D.Kington, H.B.Willard, Phys. Rev. 99, 644A (1955); verbal report.

P^{30}
15 15
2.5^{m}

τ 2.55^{m} *5*
Levels Si^{29}(p,γ) E_p = 0.3 to 1.2

E_p	Level	γ's
0.326	5.83	
0.414	5.91	0.69, 5.9,
0.696	6.18	0.69, 1.25, 2.46, 2.67 4.21
0.727	6.21	0.69, 1.44, 2.24, 3.27
0.917	6.40	0.69, 1.44, 1.98, 4.40 5.65
0.956	6.44	1.44?

S.Milani, J.N.Cooper, J.C.Harris, Phys. Rev. 99, 645A (1955); verbal report.

P^{31}
15 16
stable

μ +1.130500 I
$\nu(P^{31})/\nu(Na^{23})$ = 1.530366 *40*

H.E.Walchli, ORNL-1775 (1954).

P^{31}
15 16
stable

Abundance 100% ms
P^{28}, P^{29}, P^{30}, P^{32}, P^{33}, P^{34} absent (< 0.002%)

L.Kerwin, Can. J. Phys. 32, 757 (1954).

Level ? P^{31}(p,?γ) E_p = 1.4 to 3.4
γ 1.26 *15* scin
No evidence for other P^{31} low-lying levels

J.W.Olness, H.W.Lewis, Phys. Rev. 99, 654A (1955).

γ P^{31}(n,?γ) E_n = 3.2 scin
1.0 1.75
st 1.24 2.1
1.60

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Levels* P^{31}(γ,n) $2.5^{m}P^{30}$
12.58 *7*
12.75 *8*
12.90 *8*
13.18 *10***
13.38 *10*
Threshold = 12.33 *5*
*Sharp breaks in activation curve
**May be due to n group to 0.8 P^{30} level

R.Basile, C.Schuhl, Compt. rend. 240, 2399, 2512 (1955).

P^{32}
15 17
14.3^{d}

β^{-} 1.712 *8* P^{31}(n,γ) s
F-K linear (E_β > 0.06)

N.M.Anton'eva, A.A.Bashilov, B.S.Dzhelepov, V.I.Orlov, Izvest. Akad. Nauk Ser. Fiz. SSSR 18, 93 (1954).

$e^{+}/e^{-} < 1.3 \times 10^{-7}$ $\gamma^{\pm}\gamma^{\pm}$

A.B.Milojević, V.Z.Wintersteiger, Bull. Inst. Nuclear Sci., Boris Kidrich 5, 19 (1955).

$e^{+}/e^{-} \leq 1.5 \times 10^{-9}$ $\gamma^{\pm}\gamma^{\pm}$

J.S.Greenberg, M.Deutsch, Phys. Rev. 99, 665A (1955).

Internal bremsstrahlung energy yield per β is 2.87×10^{-3} mc^2 (21% greater than theoretical value). Spectral shape disagrees with theory for E > 600 kev. scin

K.Lidén, N.Starfelt, Phys. Rev. 97, 419 (1955).

P^{32} Resonance $P^{31}(n)$ Li(p,n)
15 17 0.147
14.3^d No resonance below 0.140

J.R.Patterson, H.W.Newson, E.Merzbacher, Phys. Rev. 99, 1625A (1955.

P^{34} γ 2.10 $S^{(34)}$(fast n,p); scin
15 19 W 4.0
12.4^s No 3.22 γ

E.Bleuler, H.Morinaga, Phys. Rev. 99, 658A (1955); verbal report.

S^{31} **Levels** **P^{31}(p,n)** **E_p = 17.5**
16 15
2.4^s

g.s. Q= -6.08 *15*	4.60 *15*
1.13 *20*	6.20 *20*
2.23 *15*	
3.29 *15*	ppl 30°, 90°, 150°

g.s. n's peaked in forward direction

A.Rubin, F.Ajzenberg, J.B.Reynolds, Phys. Rev. 98, 1185A (1955).

S^{32} Levels P^{31}(d,n) E_d = 8.13
16 16
stable

Level	l_p	
g.s.	$l_p = 0$	d,n(θ) for
(2.25)	$l_p = 2$	θ = 0° to 35°
(3.81)	$l_p = 0$	ppl
6.29 *10*		
7.28 *10*		
8.32 *10*		

F.A.El Bedewi, M.A.El Wahab, Proc. Phys. Soc. 68A, 754 (1955).

Level $S^{(32)}$(e,e') E_e = 150 to 188
6.8

J.H.Fregeau, R.Hofstadter, Phys. Rev. 98(1955). 1184A (1955); verbal report.

Levels $P^{31}(p,\gamma)$ E_p = 0.68 to 2.35
$P^{31}(p,\alpha_o)$ scin p,γ(θ)

E_p	Level	Γ_γ(ev)	Reaction	J
0.816	9.646		γ_1	
0.825	9.654	0.12	γ_o	$1^\pm$
1.117	9.937	0.63	γ_o	$1^\pm$
1.146	9.965		γ_1	
1.248	10.064	0.048; 0.74	γ_o, γ_1	$2^\pm$
1.549	10.356		γ_1	
1.892	10.688	12.0	γ_o, α_o	1^-
1.98	10.77		α_o	
1.985	10.778	4.4	γ_o	$1^\pm$
1.99	10.78		α_o	
2.027	10.819	8.7	γ_o, α_o	1^-
2.120	10.909	1.3	γ_o, α_o	1^-
2.320	11.103	6.7	γ_o	$1^\pm$
2.340	11.122	21.0	γ_o	$1^\pm$

Γ_γ's are partial widths for appropriate γ's
$\gamma_1 = \gamma$ to S^{32} 2.25 level

E.B.Paul, H.E.Gove, A.E.Litherland, G.A. Bartholomew, Phys. Rev. 99, 1339 (1955).

S^{32} Levels $P^{31}(p,\alpha)$ E_p = 1.0 to 2.5
16 16
stable

	Level	E_o	Γ(kev)	Γ_γ
22*	10.33	1.52	9	
25*	10.45	1.64	~5	
43*	10.70	1.90	27	observable
37*	10.83	2.03	18	observable

*σ(90°) in mb
12 additional resonances found with Γ < 4 kev

R.L.Clarke, E.Almqvist, E.B.Paul, Phys. Rev. 99, 654A (1955).

Levels $P^{31}(p,?\gamma)$ E_p = 1.4 to 3.4
11.1 to 12.2
21 resonances for 1.26 γ for E_p > 2.3 from (p,p')?
Resonances for 1.8 γ for E_p > 2.47 from (p,α)?

J.W.Olness, H.W.Lewis, Phys. Rev. 99, 654A (1955).

Capture γ's	$P^{31}(p,\gamma)$	E_p = 1.30	
	0.9 ?	4.4	scin
	2.25	7.8 *4*	
	2.56	9.8 *4*	
	3.8		

(E_γ > 1)(2.25γ, 3.8γ, 4.4γ)
(E_γ > 4)(0.9γ?, 2.25γ)

B.D.Kern, L.W.Cochran, Phys. Rev. 99, 645A (1955); verbal report.

S^{33} Levels $S^{(32)}$(n,p) E_n = 2.2 to 4.0
16 17 $S^{(32)}(n,\alpha_0)$ ic
stable $S^{(32)}(n,\alpha_1)Si^{29}$ 1.28 level
11.1 to 12.2
σ curves show non-coincident resonances for 3 reactions, 7 for 1st, 9 for 2nd, 6 for 3rd
$\sigma(p)/\sigma(\alpha_0) \sim 1$; $\sigma(\alpha_1)/\sigma(\alpha_0) \sim 0.3$ for all E_n

T.Hürlimann, P.Huber, Helv. Phys. Acta. 28, 33 (1955).

Capture γ's	$S^{(32)}$(th n,γ)			sπ Cp
47+	0.84 *1*	2.0+	3.66 *5*	
3+	2.00 *2*	6.0+	4.40 *2*	
5+	2.29 *3*	1.2+	4.58 *3*	
30+	2.42 *1*	12.0+	4.87 *2*	
4.4+	2.55 *3*	3.5+	5.07 *3*	
2+	2.70 *5*	48.0+	5.44 *2*	
4.0+	2.82 *2*	0.4+	5.88 *5*	
13.0+	2.98 *1*	0.5+	6.62 *5*	
2.0+	3.10 *3*	0.5+	7.20 *5*	In S^{25}?
19.0+	3.27 *1*	0.6+	7.42 *5*	
7.1+	3.41 *1*	2.6+	7.80 *4*	
		1.8+	8.63 *4*	

+Photons/100 S captures

Geneva Conf. 8/P/651 (1955), L.V.Groshev et al. (USSR). See Appendix.

S^{34}
16 18
stable

Levels $P^{31}(\alpha,p)$ $E_{\alpha}=8.1$
g.s. $Q=0.5$ scin
0.7 ?* 8.0 ?
2.1 8.6 ?
*Assignment to S^{34} uncertain

G.F.Pieper, G.S.Stanford, P. von Herrmann, Phys. Rev. 98, 1185A (1955).

S^{35}
16 19
87^{d}

β^{-} 0.165 *5* sl
Includes correction of −0.002 for 3% resolution

L.Feuvrais, T.Yuasa, Compt. rend. 239, 1627 (1954).

β^{-} (0.167) pc
After instrumental corrections F-K plot linear ($E_{\beta}>0.005$)

A.Moljk, S.C.Curran, Phys. Rev. 96, 395 (1954).

K vacancy $/\beta=2.3\times10^{-3}$ *7* pc

W.Rubinson, J.J.Howland, Jr., Phys. Rev. 96, 1610 (1954).

Internal bremsstrahlung energy yield per β is 2.23×10^{-5} mc^{2} (35% greater than theoretical value). Spectral shape also shows departure from theory. scin

N.Starfelt, N.L.Svantesson, Phys. Rev. 97, 708 (1955).

S^{37}
16 21
5.0^{m}

Levels $A^{(40)}(n,\alpha)$ $E_{n}=14.8$
1.0+ g.s. $Q=-2.5$ *1* Argon
1.4+ 1.3 *1* filled ic
2.2+ 2.2 *1*
1.2+ 2.7 *1*
1+ 3.5 ?
$\sigma\sim30$ μb for g.s. transition

E.H.Bellamy, F.C.Flack, Phil. Mag. 46, 341 (1955).

Cl
17

Abundances
Cl^{35} 75.529% $Cl^{37}/Cl^{35}=3.0865$ *27*
Cl^{37} 24.471%

A.W.Boyd, F.Brown, M.Lounsbury, Can. J. Phys. 33, 35 (1955).

Variation in ratio < 0.2% for 10 samples of different origin

H.R.Owen, O.A.Schaeffer, J. Am. Chem. Soc. 77, 898 (1955).

Cl^{32}
17 15
0.31^{s}

τ 0.306^{s} *4* $S^{(32)}$(20-Mev p,n)
α ($\sim10^{-2}$%) 2-3 scin
β^{+} ~50% 7.5 and others ($E_{\beta}<7.5$) scin
~50% 9.5 *4*
γ 70% 2.21 *3* scin
~10% 2.77 *8* or 3.79
7% 4.27 *8*
14% 4.77 *4*

N.W.Glass, J.R.Richardson, Phys. Rev. 98, 1251 (1955).

τ 0.28^{s} S(23-Mev p)

H.Tyrén, P.A.Tove, Phys. Rev. 96, 773 (1954).

Levels $S^{32}(p,n)$ $E_{p}=17.5$ ppl
1.0 90°, 150°
1.4
2.0

F.Ajzenberg, A.Rubin, J.G.Likely, Phys. Rev. 99, 654A (1955); verbal report.

Cl^{34}
17 17
1.53^{s}
g.s.

τ 1.53^{s} *2* $Cl^{(35)}$(≤22-Mev γ,n)

R.M.Kline, D.J.Zaffarano, Phys. Rev. 96, 1620 (1954).

Levels $S^{34}(p,n)$ $E_{p}=17.5$ ppl
g.s.? $Q=-6.1$ 90°, 150°
1.1 4.6
1.9 5.7 ?
2.7 7.2 ?
3.7
n group with $Q=-5.0$ also found in S target containing C and O

F.Ajzenberg, A.Rubin, J.G.Likely, Phys. Rev. 99, 654A (1955); verbal report.

Cl^{34}
17 17
32.4^{m}

γ 1.15 $Cl^{(35)}$(p,pn); scin
2.10
(1.15γ)(2.10γ)(θ) $J=2^{+}, 2^{+}, 0^{+}$

H.E.Mandler, J.R.Richardson, Phys. Rev. 98, 281A (1955).

γ 2.10 scin
3.22
vw 4.0

E.Bleuler, H.Morinaga, Phys. Rev. 99, 658A (1955); verbal report.

Cl^{35}
17 18
stable

μ +0.820905 I
$\nu(Cl^{35})/\nu(H^2) = 0.638302$ *8*

H.E.Walchli, ORNL-1775 (1954).

Levels $S^{(32)}(\alpha,p)$ $E_\alpha = 8.1$
g.s. Q = −2.3 scin
0.7 ?
1.1
1.7 ?

G.F.Pieper, G.S.Stanford, P. von Herrmann, Phys. Rev. 98, 1185A (1955).

Levels* $Cl^{(35)}(\gamma,n)$ $32.4^m Cl^{34}$
13.13 *7*
13.51 *7*
13.72 *7*
13.89 *7*
14.10 *7*
Threshold = 12.79 *7*
*Sharp breaks in activation curve

R.Basile, C.Schuhl, W.Sebaoun, Compt. rend. 241, 387 (1955).

Cl^{36}
17 19
3.1×10^{5y}

$Cl^{(35)}$(pile n,γ) chem
τ 3.08×10^{5y} ms, 4π pc

R.M.Bartholomew, A.W.Boyd, F.Brown, R.C. Hawkings, M.Lounsbury, W.F.Merritt, Can. J. Phys. 33, 43 (1955).

μ +1.2840 I
$\nu(Cl^{36})/\nu(H^2) = 0.74873$ *3*

P.B.Sogo, C.D.Jeffries, Phys. Rev. 98, 1316 (1955); 99, 613A (1955).

μ +1.32 Mic
$g(Cl^{36})/g(Cl^{35}) = 1.20$ *7*
Q −0.017
$Q(Cl^{36})/Q(Cl^{35}) = 0.2117$ *27*

L.C.Aamodt, P.C.Fletcher, Phys. Rev. 98, 1317 (1955).

Capture γ's $Cl^{(35)}$(th n,γ) 8π Cp

26+	0.49 *1*	2.1+	4.05 *5* ?
23+	0.77 *1*	2.3+	4.15 *5* ?
36+	1.17 *1*	2.2+	4.50 *5* ?
2.4+	1.60 *2*	2.3+	4.64 *5* ?
1.0+	1.67 *2*	1.9+	4.79 *5* ?
1+	1.72 *2*	6+	5.01 *4*
29+	1.97 *1*	1.6+	5.28 *5* ?
1.0+	2.51 *3*	2+	5.49 *4*
2.0+	2.68 *2*	5.6+	5.72 *3*
9.5+	2.87 *2*	21.4+	6.12 *3*
8.0+ {	3.02 *3*	14.4+	6.64 *4*
	3.09 *2*	1.9+	6.96 *4*
3.6+	3.40 *5*	14+	7.41 *3*
2.9+	3.63 *5?*	7.6+	7.78 *3*
1.8+	3.90 *5?*	2.8+	8.55 *4*

+Photons/100 Cl captures

·Geneva Conf. 8/P/651 (1955), L.V.Groshev et al. (USSR). See Appendix.

Cl^{36}
17 19
3.1×10^{5y}

Resonances Cl^{35}(n) E_n = 2 to 200 kev Li(p,n)

E_0(kev)	Γ(kev)
26.5	0.34
141	
190	

L.A.Toller, J.R.Patterson, H.W.Newson, Phys. Rev. 99, 620A (1955).

Cl^{38}
17 21
37.3^m

τ 37.7^m $Cl^{(37)}$(12-Mev d,p); sl
$\beta\gamma(\theta)$ studied; $\eta(\pi)$ given for E_β = 1.22 to 2.5

P.Macq, Bull. Acad. Roy. Belg. 41, 467 (1955); 40, 802 (1954).

Resonances Cl^{37}(n) E_n = 2 to 200 kev Li(p,n)

E_0(kev)	Γ(kev)
8.8	0.09
26.5	0.33
47.4	0.20
55.5	0.18
65.0	0.18
94.2	0.80
141	
190	

L.A.Toller, J.R.Patterson, H.W.Newson, Phys. Rev. 99, 620A (1955).

A
18

A^{36}/A^{38} variation of > 300% in radioactive ores attributed to $Cl^{35}(\alpha,p)$

G.W.Wetherill, Phys. Rev. 96, 679 (1954).

A^{37}
18 19
34^d

$\epsilon_L/\epsilon_K = 0.092^{+10}_{-5}$ (theory, 0.082)
large, Xe-filled pc

M.Langevin, P.Radvanyi, Compt. rend. 241, 33 (1955).

E_ϵ 0.812 *8* recoil

O.Kofoed-Hansen, Phys. Rev. 96, 1045 (1954).

E_{recoil} (A^{37} ions) = 9.8 ±0.7 ev
Consistent with E_ϵ = 0.816

A.H.Snell, F.Pleasonton, Phys. Rev. 97, 246 (1955); Phys. Rev. 98, 1174A (1955).

A^{40}
18 22
stable

Levels $A^{(40)}(p,p')$ E_p = 9.51 Dpl
g.s. $\sigma(\theta)$ has a max. at 120°
1.48 *2* σ asymmetric about 90°

R.G.Freemantle, D.J.Prowse, A.Hossain, J.Rotblat, Phys. Rev. 96, 1270 (1954).

A^{41}
18 23
1.8^h

$A^{(40)}$ (slow n,γ)
γ 1.298 *10* scin

J.C.Kluyver, C.Van der Leun, Physica 21, 604 (1955).

K^{38}
19 19
0.94^s

τ 0.935^s *25* $K^{(39)}$ ($\leq$22-Mev γ,n)

R.N.Kline, D.J.Zaffarano, Phys. Rev. 96, 1620 (1954).

K^{39}
19 20
stable

μ +0.39094 *8* KF I
$\nu(K^{39})/\nu(N^{14})$ = 0.64588 *6*

L.C.Brown, D.Williams, Phys. Rev. 98, 1537A (1955).

Q +0.14 *4* double resonance

G.J.Ritter, G.W.Series, Proc. Phys. Soc. 68A, 450 (1955).

Levels A^{36} (α,p) E_{α} = 7.4
g.s. Q = -1.28 *3* ppl 90°
2.48 *3*
2.87 *3*

R.B.Schwartz, J.W.Corbett, W.W.Watson, Phys. Rev. 99, 655A (1955); priv. comm.

Levels $K^{(39)}$ (p,p') E_p = 6.0, 7.0, 7.5
s, several θ

2.53	
2.82	
3.03	4.48
3.61	4.52
3.89	4.69
3.95	4.77
4.10	4.94
4.11	5.02
4.14	5.18

A.Sperduto, W.W.Buechner, Phys. Rev. 100, 961A (1955).

K^{40}
19 21
1.3×10^{9y}

τ_{β} 1.33×10^{9y} *3* a
τ_{γ} 0.133×10^{9y} *2* a
29.6±0.7 β's/sec g K and 2.96±0.04 γ's/sec g K found from 5 K salts counted in cylindrical geometry

A.D.Suttle,Jr., W.F.Libby, Anal. Chem. 27, 921 (1955).

τ_{β} 1.35×10^{9y} *5*
β^- 1.320 *20* ΔJ = 4, yes shape
From 29.2±1.0 β's/sec g K scin

S.Kono, J. Phys. Soc. Japan 10, 495 (1955).

K^{40}
19 21
1.3×10^{9y}

τ_{β} 9.6×10^{8y} *6* 42 β's/sec g K

A.Mee, A.Coche, P.Keller, M.Jarovoy, M.Wack, Ann. geophys. 10, 19 (1954).

ϵ/β = 0.085 ±0.005
From A^{40}/K^{40} measurements using Pb/U ages and assuming 29.5 β's/sec/gm K

G.J.Wasserburg, R.J.Hayden, Phys. Rev. 97, 86 (1955).

γ/β = 0.124 *2* Co^{60} external standard scin
= 0.121 *4* Na^{24} internal standard

A.M.McNair, R.N.Glover, H.W.Wilson, Phys. Rev. 99, 771 (1955).

A^{40}/K^{40} measurements give mineral ages agreeing with those from other methods assuming:
β's/sec g K = 29.4±2.7
γ/β = 0.090±0.038

H.A.Shillibeer, R.D.Russell, Can. J. Phys. 32, 681 (1954).

Resonances K^{39}(n) E_n = 2 to 120 kev
Li(p,n)

E_o (kev)	Γ(kev)
10	
23	
43	0.3
58	0.6
68	0.8
95	
110	

L.A.Toller, J.R.Patterson, H.W.Newson, Phys. Rev. 99, 620 (1955).

K^{41}
19 22
stable

$q(K^{41})/q(K^{39})$ = 1.220 *2* M

C.A.Lee, B.P.Fabricand, R.O.Carlson, I.I. Rabi, Phys. Rev. 91, 1395 (1953).

K^{42}
19 23
12.5^h

γ 10†* (0.309)
100†* (1.51)
$\gamma\gamma(\theta)$ J = 4, 2, 0
*Disagrees with results of Lazar and Bell [see NSA 8, 24B (1954)]

V.Cappeller, R.Klingelhöfer, Z. Naturf. 9a, 1052 (1954).

γ 10.8%* (1.53) $K^{(41)}$ (pile n,γ)
*γ rate from Ra calibrated ic, total β rate from 4π counter. See also Rb^{86}

E.W.Emery, N.Veall, Proc. Phys. Soc. 68A, 346 (1955).

K^{42}
19 23
12.5^h

Resonances $K^{41}(n)$ $E_n = 2$ to 120 kev

E_o (kev)	Γ (kev)	Li(p,n)
10		
23		
39	0.9	
58		
86		
110		

L.A.Toller, J.R.Patterson, H.W.Newson, Phys. Rev. 99, 620A (1955).

K^{43}
19 24
22^h

β^- 20% 0.24 Ta^{181}(340-Mev p); a
80% 0.80

γ 100† 0.375 10 scin
~100† 0.615 10

W.E.Nervik, G.T.Seaborg, Phys. Rev. 97, 1092 (1955).

Levels $A^{40}(\alpha,p)$ $E_\alpha = 7.4$
g.s. Q = -3.36 3 ppl 90°
0.65 3
1.17 5

R.B.Schwartz, J.W.Corbett, W.W.Watson, Phys. Rev. 99, 655A (1955); priv. comm.

Ca^{39}
20 19
0.9^s

τ 0.90^s 1 $Ca^{(40)}$(≤19.5-Mev γ,n)

R.M.Kline, D.J.Zaffarano, Phys. Rev. 96, 1620 (1954).

Ca^{40}
20 20
stable

Level $Ca^{(40)}(p,p' + e^+e^-)$ $E_p = 4.84$
3.46 10 $J = 0^+$ sl pr
No photon; pairs identified

R.D.Bent, T.W.Bonner, J.H.McCrary, Phys. Rev. 98, 1325, 1198A (1955).

Ca^{42}
20 22
stable

Levels $K^{39}(\alpha,p)$ $E_\alpha = 8.2$
g.s. Q = -0.19 7 a
1.51 5 3.02 5
1.95 7 3.30 10*
2.29 5 3.75 7
2.59 7 4.09 10*
*Observed only with $E_\alpha = 7.75$

J.P.Schiffer, Phys. Rev. 97, 428 (1955).

Ca^{43}
20 23
stable

Levels $Ca^{42}(d,p)$ $E_d = 7$ sπ

	Level	l_n	
70†*	g.s.	3	d,p(θ)
< 10†	0.37		
40†	0.595	1	
20†*	0.993	3(2 possible)	
v st	1.95	0*	

No 0.84 level (< 5†)*
†Relative intensity at peak

C.K.Bockelman, C.M.Braams, W.W.Buechner, D.B.Guthe, Phys. Rev. 99, 655A (1955);
*verbal report and priv. comm.

Ca^{44}
20 24
stable

Levels $Ca^{43}(d,p)$ $E_d = 4.15$
g.s. Q = 9.07 7 a
1.15
2.28
At 90° $\sigma[Ca^{40}(d,p)]/\sigma[Ca^{43}(d,p)] \sim 50$ for g.s. groups and ~100 for 1st excited state groups;
$\sigma[K^{41}(\alpha,p)]/\sigma[Ca^{43}(d,p)] \sim 70$ a

$K^{41}(\alpha,p)$ $E_\alpha = 8.2$
g.s. Q = 0.98 10 a
1.13 5 2.58 5
1.92 5 2.97 5
2.28 5 3.17 5

J.P.Schiffer, Phys. Rev. 97, 428 (1955).

Ca^{47}
20 27
4.8^d

τ 4.7^d 2 Ca^{46}(slow n,γ) chem
V(380-Mev p) chem

β^- 83% 0.660 10 sl
17% 1.940 20

γ 1† 0.48 2 scin
1† 0.83 2
~13† 1.31 2
No 0.150 γ, 0.160 γ, 0.234 γ
(0.48 γ)(0.83 γ) No(1.31 γ) γ scin

L.J.Lidofsky, N.Benczer, V.K.Fischer, Phys. Rev. 99, 658A (1955); verbal report.

Ca^{48}
20 28

τ_β $\geq 2 \times 10^{14y}$ Natural Ca pc
From absence of negatrons

H.Selig, Thesis, Carnegie Inst. Tech. (1954).

$\tau_{\beta\beta}$ 1.6×10^{17y} 7 84% Ca^{48}
$E_{\beta\beta}$ 4.1 3 scin
$E_{\beta\beta}$ shows peak at 4.1 suggesting $\beta\beta$ decay without ν's

J.A.McCarthy, Phys. Rev. 97, 1234 (1955).

Sc^{40}
21 19
0.22^s

τ 0.22^s 3 $Ca^{(40)}$(20-Mev p,n)
β^+ 9.0 4 scin
γ 3.75 4
No α; no other strong γ

N.W.Glass, J.R.Richardson, Phys. Rev. 98, 1251 (1955).

τ ~0.35^s $Ca^{(40)}$(23-Mev p,n)

H.Tyrén, P.A.Tove, Phys. Rev. 96, 773(1954).

Sc^{41}
21 20
0.87^s

Levels $Ca^{(40)}(d,n)$ $E_d = 4.18$
g.s. Q = -0.60 5
0.82* 2.05
1.07* 2.25
1.74 ppl 0°, 30°, 45°, 90°
*Assignment uncertain

H.S.Plendl, F.E.Steigert, Phys. Rev. 98, 1538A (1955); verbal report.

Sc^{44}
21 23
4.0^{h}
g.s.

β^{+} 94% 1.47 sl
ϵ 6% $\gamma\gamma^{\pm}/\gamma^{\pm}$, Na^{22}
γ 100% 1.159 $\alpha = 6.3\times10^{-5}$ scin
0.12% 2.54
No 1.38 γ ($<0.5\%$)
$(1.16\gamma)\,\gamma^{\pm}$
Origin of 4% soft e's (attributed to IB; Bruner, Phys. Rev. 84, 282) questioned

J.W.Blue, E.Bleuler, Phys. Rev. 99, 659A (1955); verbal report.

Sc^{44}
21 23
2.4^{d}

γ 0.27 $\alpha = 0.139^{*}$ E4 (M4 ?)

J.W.Blue, E.Bleuler, Phys. Rev. 99, 659A (1955); *verbal report.

Sc^{45}
21 24
stable

$Sc^{45}(p,p'\gamma)$ $E_p \leq 2.75$
No γ with $E_\gamma < 0.6$ scin

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

Levels $Sc^{45}(p,p')$ $E_p = 5.03$ sm
0.377 *5* 1.235 *5*
0.541 *5* 1.409 *5*
0.722 *5* 1.432 *5*
0.972 *5* 1.661 *5*

G.C.Phillips, C.R.Gossett, J.P.Schiffer, P.M. Windham, Phys. Rev. 99, 655A (1955).

Sc^{46}
21 25
84^{d}

$\gamma\gamma$ delay $< 30^{\mu\mu s}$
$\beta\gamma$ delay $< 30^{\mu\mu s}$

R.E.Azuma, Phil. Mag. 46, 1031 (1955).

$(1.12\gamma)(0.89\gamma)(\theta)$ J = 4, 2, 0 scin
Graph of $\eta(\theta)$ given $(\pi/2 < \theta < \pi)$; $\eta(\pi) = 0.162$

T.Hayashi, M.Kawamura, A.Aoki, J. Phys. Soc. Japan 10, 334 (1955).

Resonances $Sc^{45}(n)$ $E_n = 0.0015$ to 5000 ev
−0.13 *3* kev $\Gamma_n = 840 \pm 25$ mv
$\Gamma_\gamma = 250 \pm 10$ mv
3.6 $\Gamma = 180$ ev $\sigma_0\Gamma^2 \sim 3\times10^{7}$
slow and fast chopper, cryst

N.J.Pattenden, Proc. Phys. Soc. 68A, 104 (1955).

Sc^{47}
21 26
3.43^{d}

$Ca^{(48)}$(14-Mev p,2n); chem
τ 3.45^{d} *10*
β^{-} 0.46 *2* a$\beta\gamma$
0.62 *3* a
γ 66% 0.157 *7* β/γ scin
No other γ No Ti x rays
$(0.46\beta)(0.157\gamma)$ No $(0.62\beta)\,\gamma$

W.S.Lyon, B.Kahn, Phys. Rev. 99, 728 (1955).

Sc^{47}
21 26
3.43^{d}

β^{-} 74% 0.450 *5* d 4.8^{d}Ca chem; sl
26% 0.610 *5*
γ 100+ 0.160 *5* scin
No other γ with $E_\gamma > 0.16$ (<0.01+)
$\beta(0.160\gamma)$ scin

L.J.Lidofsky, N.Benczer, V.K.Fischer, Phys. Rev. 99, 658A (1955); verbal report.

Ti
22

Relative abundances

Ti^{46}	7.99	Ti^{49}	5.46
Ti^{47}	7.32	Ti^{50}	5.25
Ti^{48}	73.99		

J.E.Hogg, Can. J. Chem. 32, 1039 (1954).

γ $Ti(n,?\gamma)$ $E_n = 3.2$ scin
st 0.92
1.30
2.2

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Ti^{43}
22 21
0.58^{s}

τ 0.58^{s} Ti(80-Mev p)

H.Tyrén, P. A.Tove, Phys. Rev. 96, 773 (1954).

Ti^{44}
22 22
$\geq 23^{y}$

τ $\geq 23^{y*}$ Sc^{45}(30-Mev p,2n) chem
γ 0.16 scin
p 4.0^{h}Sc chem Not p 2.4^{d}Sc

R.A.Sharp, R.M.Diamond, Phys. Rev. 93, 358 (1954); * 96, 1713 (1954).

Ti^{46}
22 24
stable

Level $Ti^{(46)}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; scin
γ 0.890 *14* $\tau = 1.8^{\mu\mu s}$

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 99, 617A (1955); *verbal report.

Ti^{47}
22 25
stable

Levels $Ti^{46}(d,p)$ $E_d = 4.16$ pc
g.s. } d,p(θ) shows compound
(0.160) } nucleus formation
(1.40) $l_n = 1$ stripping

L.L.Lee, Jr., W.Rall, Phys. Rev. 99, 1384 (1955).

Level $Ti^{47}(\alpha,\alpha'\gamma)$ $E_\alpha = 1.2$ to 3.4
γ 0.160 $\epsilon B(E2) = 0.047$ scin
Previously reported 0.433 γ not in Ti*

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 96, 426 (1954); 93, 351 (1954); *priv. comm.

Ti^{48}
22 26
stable

Level $Ti^{(48)}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; scin
γ 0.990 *15* $\tau = 1.5 \times 10^{-12}s^*$

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 99, 617A (1955); *verbal report.

Ti^{49}
22 27
stable

Levels $Ti^{(48)}(d,p)$ $E_d = 2.6$
~0.5* (g.s.) ppl
6* (1.35)
4* (1.70)
~2* (2.41)
*σ in units of 10^{-4} barns
d,p(θ) of groups to 1.40 and 1.74 levels suggest stripping (with coulomb effects) rather than compound nucleus formation

W.W.Pratt, Phys. Rev. 97, 131 (1955).

Levels $Ti^{48}(d,p)$ $E_d = 4.16$ pc
(1.35) d,p(θ) shows deviations
(1.70) from $l_n = 1$ stripping

L.L.Lee, Jr., W.Rall, Phys. Rev. 99, 1384 (1955).

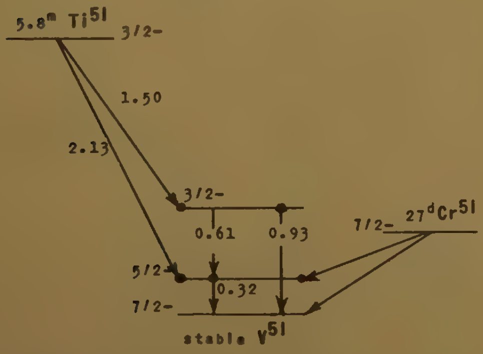
Resonances $Ti^{48}(n)$ E_n = 1 to 55 kev

E_o (kev)	J	l	Γ(kev)
18	1/2	0 or 1	~4
38	1/2	0	1.2
53	1/2	0	2.5

C.T.Hibdon, A.Langsdorf, Jr., Phys. Rev. 98, 223A (1955); verbal report.

Ti^{51}
22 29
5.8^m

τ 5.80^m *3* Ti^{50}(pile n,γ)
β^- 1.50 *5* scin
2.13 *3* F-K linear($E_\beta > 1.5$)
γ 95.8† 0.323 *2* scin
1.4† 0.605 *4*
4.2† 0.928 *5*
(1.50 β)(0.928 γ) (2.13 β)(0.323 γ)
(0.323 γ)(0.605 γ) No other $\gamma\gamma$
No 0.48 γ (<0.4†)



M.E.Bunker, J.W.Starner, Phys. Rev. 97, 1272 (1955).

Ti^{51}
22 29
5.8^m

$Ti^{(50)}$(14-Mev d,p)
β^- 2.17 *4* scin
γ 100† 0.325 scin
6† 0.935 *15*
(2.17 β)(0.325 γ)
No 2.55 β (<20%) No 0.48 γ (<3†)

M.J.Sterk, R.H.Nussbaum, A.H.Wapstra, Physica 21, 441 (1955).

Ti^{51}
22 29
5.8^m

β^- 2.13 *3* F-K linear ($E_\beta > 0.7$)sl
γ 100† 0.32 scin
1.5† 0.45-0.7 $\gamma\gamma$ scin
(0.32 γ)(>1.9 β) (0.32 γ)(0.45 < E_γ < 0.7)
No β^- with $E_{\beta^-} > 2.1$ (<5%)
No 0.93 γ (<6†)
$V^{(51)}$(fast n,p) chem; Ti^{50}(d,p)

Th.Mayer-Kuckuk, H.Daniel, Z.Naturf. 10a, 168 (1955).

Ti^{50}(pile n,γ)
β^- 1.8 a β(0.92 γ)
2.4 a β(0.32 γ)
γ 100† (0.32) scin
1† 0.610 *15*
5† 0.920 *15*
(2.4 β)(0.32 γ) (1.8 β)(0.92 γ)
(0.32 γ)(0.61 γ) No (0.32 γ)(0.92 γ)
No β^- to g.s. (<15%) β(0.32 γ) / β

W.C.Jordan, S.B.Burson, J.M.LeBlanc, Phys. Rev. 96, 1582 (1954); 98, 230A (1955).

V
23

Resonances V(n) E_n = 2 to 100 kev

E_o (kev)	E_o (kev) Li(p,n)	
4.1	22.2	
6.6	69.1	J = 4
11.5	87.1	J = 3
16.6		

Other weaker resonances with 22 < E_o < 70

H.Marshak, H.W.Newson, Phys. Rev. 98, 1162A (1955).

V^{46}
23 23
0.4^s

τ 0.4^s Ti(23-Mev p)
See also Cr^{47} V(57-Mev p)

H.Tyrén, P. A.Tove, Phys. Rev. 96, 773 (1954).

V^{47}
23 24
31.1^m

τ 31^m *1* Ti(13-Mev d)
β^+ 1.89 *1* F-K plot linear sl
No ce 0.16 γ ($<$0.08% of β^+)
No pe (0.05 to 0.21 Mev)

H.Daniel, Z. Naturf. 9a, 974 (1954).

V^{48}
23 25
16.2^d

β^+ 0.694 *6* s?
No 2.01 β^+ ($<$0.1%) No other β^+

L.E.Killion, Washington University, Dissertation Abstr. 15, 858 (1955).

V^{49}
23 26
334^d

τ 334^d *20* Cr(22-Mev p) chem
x Ti K x rays pc
No β^+ ($<$0.05%) GM, scin
No γ with $0.51 > E_\gamma > 0.03$ ($<$0.05%) scin
No ce GM

W.S.Lyon, Phys. Rev. 97, 121 (1955).

τ 327^d *20* $Ti^{(48)}$(15-Mev d,n) chem
No 0.080 γ, 0.120 γ, 0.128 γ pc, scin
$E_\epsilon = 0.622$ *10* γ continuum
Shape of γ continuum in agreement with theory by Glauber and Martin

R.W.Hayward, D.D.Hoppes, Phys. Rev. 99, 659A (1955); verbal report.

V^{50}
23 27
$>3 \times 10^{15}y$

μ +3.34128 I
$\nu(V^{50})/\nu(H^2) = 0.649518$ *8*

H.E.Walchli, ORNL-1775 (1954).

τ $>3 \times 10^{15}y$ GM, pc
Absence of 1.6 γ, 1.2 β^-, 1.4 β^+, Ti K x rays gives $\tau > 3 \times 10^{15}\gamma$, $3 \times 10^{14}\gamma$, $10^{15}y$, $3 \times 10^{14}y$ resp.

J.Heintze, Z. Naturf. 10a, 77 (1955).

τ_β $\geq 3 \times 10^{14}y$ Natural V chem; pc
τ_{ϵ_K} $\geq 2 \times 10^{14}y$
From absence of negatrons and Ti K x rays

H.Selig, Thesis, Carnegie Inst. Tech. (1954).

V^{51}
23 28
stable

Level $V^{(51)}(p,p'\gamma)$ $E_p \geq 1.3$; γ scin
0.325

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

γ $V^{(51)}(n,?\gamma)$ $E_n = 3.2$ scin
st 0.33
0.97
1.67

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

V^{53}
23 30

No evidence for $23^h V^{53}$ Cr^{53}(fast n)
Ti^{50}(49-Mev α) chem

R.K.Sheline, J.R.Wilkinson, B.J.Dropesky, T.T.Shull, Phys. Rev. 99, 1055 (1955).

Cr
24

γ Cr(n,?γ) $E_n = 3.2$ scin
0.03† 0.75
0.10† 0.97
0.73† 1.43
†σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Cr^{46}?
24 22

τ 1.1^s V(57-Mev p)
Cr(165-Mev p)

H.Tyrén, P.A.Tove, Phys. Rev. 96, 773 (1954).

Cr^{47}?
24 23

τ 0.4^s V(57-Mev p)
See also V^{46} and Mn^{49} Cr(100-Mev p)

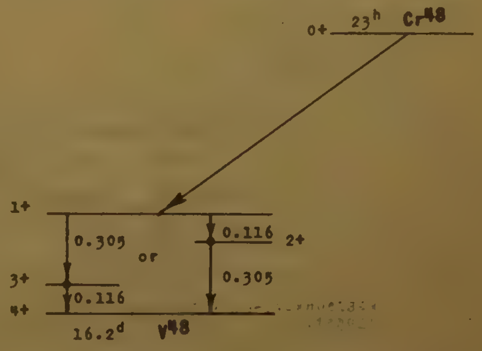
H.Tyrén, P. A.Tove, Phys. Rev. 96, 773 (1954).

Cr^{48}
24 24
23^h

τ 24^h *1* Ti^{46}(50-Mev α, 2n) chem
γ 100† 0.118 scin
~100† 0.307
(0.118 γ)(0.307 γ) Σ scin
No other γ No β^+ ($<$2%) D 16.2^dV

R.K.Sheline, J.R.Wilkinson, Phys. Rev. 99, 165 (1955); 98, 1538A (1955).

τ 23^h *1* Ni(380-Mev p) chem
D 16.2^dV
γ 95† 0.116 *4* $a \sim 0.02$ M1 } sl ce
100† 0.305 *10* $a \sim 0.006$ E2 } scin
No β^+ ($<$2%), no other γ's ($<$0.2%)
(0.116 γ)(0.305 γ) scin



R. van Lieshout, D.H.Greenberg, C.S.Wu, Phys. Rev. 98, 1171A (1955).

Cr^{51} γ 9.8% (0.32) $\alpha_K = 1.5 \times 10^{-3}$ M1 scin
24 27 $x\gamma/x = 0.098$
27^d

M.E.Bunker, J.W.Starner, Phys. Rev. 97, 1272 (1955); 99, 1906 (1955).

0.325 *5* M1 sl ce, Cp
$\alpha = 1.45 \pm 0.15 \times 10^{-3}$

Z.O'Friel, A.H.Weber, Phys. Rev. 99, 659A (1955); verbal report.

Level $Ti^{(48)}(\alpha, n\gamma)$ $E_\alpha = 6.0$
$V^{(51)}(p, n\gamma)$
γ 0.750 *11* scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 99 617A (1955).

$Cr^{53?}$ γ $Cr^{53}(p, p'\gamma)$ $E_p = 1.3$; γ scin
24 29 0.155 $\epsilon B(E2) = 0.015$
stable

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

$Mn^{49?}$ τ 0.4^s Cr(100-Mev p)
25 24 See also Cr^{47}

H.Tyrén, P. A.Tove, Phys. Rev. 96, 773 (1954).

Mn^{50} τ 0.26^s Cr(45-Mev p)
25 25 0.28 Mn^{55}(95-Mev p)
0.3^s

H.Tyrén, P. A.Tove, Phys. Rev. 96, 773 (1954).

Mn^{52} τ 5.72^d *2* $Cr^{(52)}$(15-Mev d, 2n)
25 27 Counted for 104 days chem
5.72^d

E.W.Backofen, R.H.Herber, Phys. Rev. 97, 743 (1955).

$\beta^+/\epsilon = 0.47 \pm 0.03$ $\gamma^\pm\gamma^\pm/\gamma$ GM

R.Sehr, Z.Phys. 137, 523 (1954).

Mn^{53} τ 140^y Cr^{53}(9.5-Mev p,n); chem
25 28 x K x ray a GM
No γ
Assumed $\sigma[Cr^{53}(p,n)] \sim \sigma[Cr^{54}(p,n)]$

J.R.Wilkinson, R.K.Sheline, Phys. Rev. 99, 752, 1630A (1955).

Mn^{54} τ 291^d *1* $Cr^{(54)}$(15-Mev d, 2n)
25 29 Counted for 104 days chem
291^d

E.W.Backofen, R.H.Herber, Phys. Rev. 97, 743 (1955).

τ 290^d *10* $Cr^{(54)}$(d, 2n)
From analysis of decay of 20 samples

P.Kafalas, Thesis, MIT August 1954.

γ (0.835) $Fe^{(56)}(d, \alpha)$ chem
Anisotropy up to 90% in $\gamma(\theta, T)$ shows 0.835 γ is not dipole and that angular momentum of $e^- + \nu$ is the minimum for given J_i and J_f

M.A.Grace, C.E.Johnson, N.Kurti, H.R.Lemmer, F.N.H.Robinson, Phil. Mag. 45, 1192 (1954).

γ (0.835) $Fe^{(56)}(d, \alpha)$ chem
Polarization as $f(\theta, T)$ shows that if quadrupole, 0.835 γ is E2

G.R.Bishop, J.M.Daniels, H.Durand, C.E.Johnson, J.Perez, Phil. Mag. 45, 1197 (1954).

Mn^{55} q +0.4 *2* S
25 30
stable

K.Murakawa, J. Phys. Soc. Japan 10, 736 (1955); Phys. Rev. 92, 325 (1955).

q +0.6 MnO_3F Mic
q coupling compared with that for ReO_3Cl

A.Javan, A.Engelbrecht, Phys. Rev. 96, 649 (1954).

Level $Mn^{55}(n, n'\gamma)$ $E_n = 0.2$ to 1.0
γ 0.128 *2* J = 7/2

D.A.Lind, J.J.Van Loef, Phys. Rev. 99, 621A (1955); Phys. Rev. 98, 224A (1955)

Level $Mn^{55}(p, p'\gamma)$ $E_p = 3.50$
γ 0.128 $s\pi$ ce

E.M.Bernstein, H.W.Lewis, Phys. Rev. 99, 617A (1955).

Level $Mn^{55}(p, p')$ $E_p = 4.6$ to 5.7 $s\pi$
0.128 *7*

J.P.Schiffer, P.M.Windham, C.R.Gossett, G.C. Phillips, Phys. Rev. 99, 655A (1955).

Mn^{55}
25 30
stable

Level Mn^{55}(α,$\alpha'\gamma$) E$_\alpha$ = 3.5
γ 0.128 ϵB(E2) = 0.070 scin
E2 excitation E2 from α yield/p yield

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 96, 426 (1954); 93, 351 (1954).

Levels Mn^{55}(p,p'γ) E$_p$ = 2.1; γ scin
0.131* ϵB(E2) = 0.087
0.975**
*Yield curve given for E$_p$ = 0.55 to 2.5
**May be due to Mn^{55}(p,n γ)

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

γ Mn^{55}(n,n'γ) E$_n$ = 0.7 to 1.3
st 0.126 *3* scin
20† 0.853 *7**
1† ~0.98
*Graph of σ from threshold (0.98) to 1.3

J.M.Freeman, Phil. Mag. 46, 12 (1955).

γ Mn^{55}(n,?γ) E$_n$ = 3.2 scin
0.58 1.50
0.67 st 1.86
st 0.83 st 2.2
1.16

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Mn^{56}
25 31
2.58^h

Resonances Mn^{55}(n) E$_n$ = 2 to 100 kev

E$_0$ (kev)		E$_0$ (kev)	
2.4	J = 3	21.2	
7.3		27.3	
9.0		35.1	J = 3

Other weak resonances present Li(p,n)

H.Marshak, H.W.Newson, Phys. Rev. 98, 1162A (1955).

Resonances Mn^{55}(n,n'γ) E$_n$ = 0.98 to 1.3
Graph of yield of 0.853 γ scin

J.M.Freeman, Phil. Mag. 46, 12 (1955).

Fe
26

Levels Fe(n,n') E$_n$ = 4.4
ppl 90°

0.08†	g.s.
0.036†	0.8
0.021†	2.0
0.012†	2.6
0.020†	3.0

†barns/sterad at 90°

B.Jennings, J.Weddell, I.Alexeff, R.L.Hellens, Phys. Rev. 98, 582 (1955); 95, 636A (1954); 99, 621 (1955).

Fe
26

Levels Fe(n,n') E$_n$ = 15.4
scin 90°
~1.9
4.5 *11*
5.8 *10*
7.6 *8*

R.Ramanna, N.Veeraraghavan, P.K.Iyengar, Nuovo Cim. 1, 623 (1955).

γ Fe(n,n'γ) E$_n$ = 2.7 scin
0.462 1.42
0.634 1.59
0.851 1.76
0.989 2.10
1.24 2.66

D.L.Lafferty, L.A.Rayburn, T.M.Hahn, Phys. Rev. 96, 381 (1954); 95, 301A, 637A (1954).

γ Fe(n,n'γ) E$_n$ = 3.2 scin
1.18† 0.84
0.39† 1.17
0.33† 1.67
†σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

γ's Fe(n,n'γ) E$_n$ = 4.4 scin
0.85 2.1
1.20 2.5
1.73 3.0

R.M.Sinclair, Phys. Rev. 98, 1147A (1955); verbal report.

γ Fe(n,n'γ) E$_n$ = 4.5 scin
0.85 *2*
1.20 *3*
1.73 *4*
2.05 ⎤ not clearly resolved
2.50 ⎦
3.52 *9*

G.L.Griffith, Phys. Rev. 98, 579 (1955).

Fe^{54}
26 28
stable

Level Fe^{54}(n,n'γ) E$_n$ = 2.5
1.40 *5* n scin,γ scin

L.E.Beghian, D.Hicks, B.Milman, Phil. Mag. 46, 963 (1955).

Level Fe^{54}(n,n'γ) E$_n$ = 4.4
1.40 *2* γ scin
No other γ with E$_\gamma$ < 3.0

R.M.Sinclair, Phys. Rev. 99, 1351; 98, 1147A (1955).

Level Fe^{54}(p,p') E$_p$ ≤ 5.7 mag
1.413 *5*

G.C.Phillips, C.R.Gossett, J.P.Schiffer, P.M. Windham, Phys. Rev. 99, 655A (1955).

Fe^{55}
26 29
2.9^{y}

Level $Fe^{54}(d,p)$ $E_d = 10$ a
g.s. Q = 7.18 *7*

C.E.McFarland, F.B.Shull, A.J.Elwyn, B.Zeldman, Phys. Rev. 99, 655A (1955); priv. comm.

Levels $Mn^{55}(p,n\gamma)$ $E_p = 2.1$; γ scin
0.420
0.505
0.650 ?
0.975*
*May also be due to $Mn^{55}(p,p'\gamma)$

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

Fe^{56}
26 30
stable

Level $Fe^{(56)}(p,p')$ $E_p = 17$
~40* (0.84)
*σ in mb
Angular distribution and σ suggest applicability of the direct interaction theory [see Phys. Rev. 92,350(1953)]

G.Schrank, P.C.Gugelot, I.E.Dayton, Phys. Rev. 96, 1156 (1954).

Level $Fe^{56}(p,p')$ $E_p \leq 5.7$ $s\pi$
0.845 *5*

G.C.Phillips, C.R.Gossett, J.P.Schiffer, P.M. Windham, Phys. Rev. 99, 655A (1955).

Level $Fe^{(56)}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; scin
0.854 *13* $\tau = 2.9^{\mu\mu s*}$

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 99, 717A (1955); verbal report.

Level $Fe^{(56)}(n,n'\gamma)$ $E_n = 0.7$ to 1.8
0.841 *5* scin
Graph of σ from threshold to 1.8

J.M.Freeman, Phil. Mag. 46, 12 (1955).

Level $Fe^{(56)}(n,n'\gamma)$ $E_n = 1.77$
(0.85) J = 2+ $n,\gamma(\theta)$

J.J.Van Loef, D.A.Lind, Phys. Rev. 98, 224A (1955); 99, 621A (1955); verbal report.

Levels $Fe^{56}(n,n'\gamma)$ $E_n = 2.5$
0.85 *3* n scin, γ scin
2.07 *5* γ scin

L.E.Beghian, D.Hicks, B.Milman, Phil. Mag. 46, 963 (1955).

Fe^{56}
26 30
stable

Resonances $Mn^{55}(p,p' + 0.131\gamma)$ γ scin
Graph of yield given for $E_p = 0.55$ to 2.5

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

Fe^{57}
26 31
stable

Levels $Fe^{56}(d,p)$ $E_d = 10$ a

	Level	l_n	
6+	g.s.	1	Q = 5.49 *6*
2+	1.24 *6*	1	
1+	1.65 *6*		
10+	2.46 *6*		
3+	3.23 *6*		
3+	4.11 *10*		

Level $Fe^{57}(d,p)$ $E_d = 10$
g.s. $l_n = 1$

C.E.McFarland, F.B.Shull, A.J.Elwyn, B.Zeldman, Phys. Rev. 99, 655A (1955); priv. comm.

Level $Fe^{(56)}$(polarized th n,γ)
g.s. J = 1/2
From left circular polarization of g.s. 7.64γ

G.Trumpy, Nature 176, 507 (1955).

Levels $270^{d}Co^{57}$ source chem
$J = 3/2^-$ (0.014) 0.123γ (θ,T), scin
$J = 5/2^-$ (0.137) γ polarization
0.123γ is M1(96%) + E2(4%)

G.R.Bishop, M.A.Grace, C.E.Johnson, A.C. Knipper, H.R.Lemmer, J.Perez y Jorba, R.G. Scurlock, Phil. Mag. 46, 951 (1955).

Levels $Fe^{57}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.5$
γ (0.014) scin
0.123*
(0.137) $\epsilon B(E2) = 0.043$
*Excitation function suggests γ emitted from 0.137 level

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 96, 426 (1954); 93, 351 (1954); 95, 629A (1954).

Level $Fe^{57}(p,p'\gamma)$ $E_p = 0.58$; γ scin
(0.137) $\epsilon B(E2) \sim 0.015$

H.R.Lemmer, O.J.A.Segaert, M.A.Grace, Proc. Phys. Soc. 68A, 701 (1955).

Resonances $Fe^{(56)}(n,n'\gamma)$ $E_n = 0.7$ to 1.8
Graph of yield of 0.841 γ scin

J.M.Freeman, Phil. Mag. 46, 12 (1955).

Fe^{58}
26 32
stable

Levels $Fe^{57}(d,p)$ $E_d = 10$ a

	Level	l_n
1+	g.s.	1
8+	0.79 *7*	1
25+	1.62 *6*	1
50+	2.67 *7*	1
50+	4.21 *7*	1

Q = 7.89 *7*

C.E.McFarland, F.B.Shull, A.J.Elwyn, B.Zeidman, Phys. Rev. 99, 655A (1955); priv. comm.

Fe^{61}
26 35
5.5^m

τ 5.5^m $Cu^{(65)}$ (> 20-Mev n,αp)
β^-, γ scin
D 1.65^h Co chem Also produced by
$Ni^{(64)}$ (> 20-Mev n,α) and $Ni^{(64)}$ (28-Mev d,αp)

E.Ricci, J.Pahissa Campa, N.Nussis, Z. Naturf. 10a, 654 (1955).

Co^{54}
27 27
0.2^s

τ 0.20^s Fe (23-Mev p)
See also Cu^{57} Ni (50-Mev p)

H.Tyrén, P.A.Tove, Phys. Rev. 96, 773 (1954).

Co^{56}
27 29
77^d

$|\mu|$ 2.8 *9** $\gamma(\theta,T)$; scin
γ (0.845) $\Delta J = 2$
(1.24) $\Delta J = 2, 0$
(1.75) $\Delta J = 1$
(2.30)
(2.60) $\Delta J = 1$
(3.25) $\Delta J = 0, 2$
*Assuming J = 4

L.J.Gallaher, C.Whittle, J.A.Beun, A.N.Diddens C.J.Gorter, N.J.Steenland, Physica 21, 117 (1955).

γ (0.845) 2.03 scin
1.24 2.60
1.75 3.25
2.30 peak* probably escape peak of 3.25γ
(1.5β)(0.845γ, 1.24γ) scin
(1.24γ)(0.845γ)(θ) J = 4, 2, 0 (or 2, 2, 0)
(1.75γ)(1.24γ)(θ) J = 5, 4, 2 (or 3, 4, 2)
(2.03γ)(1.24γ)(θ) J = 4, 4, 2
(1.75γ)(0.845γ)(θ) for the 1st - 3rd correlation has same shape as (1.75γ)(1.24γ)(θ) 1st - 2nd correlation

M.Sakai, J. Phys. Soc. Japan, 10, 729 (1955).
*Phys. Rev. 95, 101 (1954).

Co^{57}
27 30
270^d

τ 267^d
β^+ vw ~0.30 sd

			K : L : M	
γ	30*	0.0146	30 : 10 : 2.5	sπ ce
		0.029		scin
		0.0998		scin, sπ ce
	100*	0.1228	100 : 9 : 1.5	sd, sπ ce
	80*	0.1374	80 : 8	sd, sπ ce
		0.700		scin

(0.029γ)(0.100γ, 0.700γ) scin
No (0.029γ)(0.123γ, 0.137γ)
No (0.700γ)(0.100γ, 0.123γ, 0.137γ)
*Relative intensity of ce_K

J.M.Cork, M.K.Brice, L.C.Schmid, Phys. Rev. 99, 703 (1955).

Co^{57}
27 30
270^d

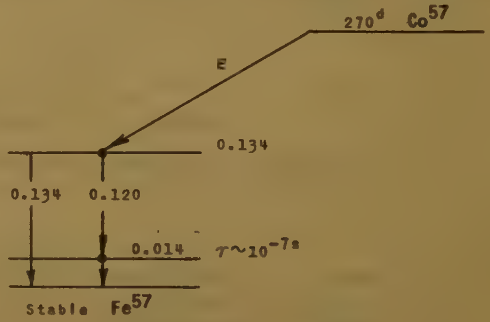
β^+ vw (may be impurity) $\gamma^{\pm}$ GM, scin
ε 100% K x ray Σscin, scin
γ ~100%* 0.014 α not low*
~100% 0.120 α < 0.1
(0.014 γ)(0.120 γ) delay ~10^{-7s}
(0.014 γ) x observed*

L.Madansky, F.Rasetti, Phys. Rev. 97, 837 (1955); *priv. comm. April (1955).

$Ni^{(58)}$ (22-Mev p, 2p) chem
No β^+ (< 2×10^{-3}%) sl, scin
γ 1* 0.123 *2* scin, sl ce
1* 0.137 *2*
No other γ's with $0.05 < E_\gamma < 0.6$ scin
*Relative intensities of ce

B.Crasemann, D.L.Manley, Phys. Rev. 98, 66 (1955).

$Fe^{(56)}$ (18-Mev d, n) chem
γ 0.0144 *1* α = 15 *1* pc, scin
(0.123)
(0.137)
No β^+ (< 0.08% from absence of $\gamma^{\pm}$) scin
(0.0144 γ)(0.123 γ) delay = 1.0×10^{-7s} *1*
x(~0.13 γ) delay < 5×10^{-8s}
Delay reversal shows 0.014 γ follows 0.123 γ
No ε to g.s. or 0.014 level in Fe^{57} (< 14%)
x/γ, xγ/γ scin



H.R.Lemmer, O.J.A.Segaert, M.A.Grace, Proc. Phys. Soc. 68A, 701 (1955).

Co^{58}
27 31
72^d

g(Co^{58} g.s.)/g(Co^{60} g.s.) = constant for all temperatures γ(θ,T); scin
μ(Co^{58} g.s.)/μ(Co^{60} g.s.) calculated for different assumptions of spin and interaction

J.C.Wheatley, D.F.Griffing, R.D.Hill, Phys. Rev. 99, 334 (1955).

τ 71.0^d
β^+ 0.485 *10* sd
γ st 0.500 scin $\gamma\gamma^{\pm}(\theta)$, βγ
st 0.814 K/LM large scin
w 1.3 ?
β(0.500γ, 0.814γ) $\gamma^{\pm}$(0.500γ, 0.814γ)
No other β^+

J.M.Cork, M.K.Brice, L.C.Schmid, Phys. Rev. 99, 703 (1955).

Co^{59}
27 32
stable

Co^{59}(p,p'γ) $E_p \leq 2.75$
No γ with $E_\gamma < 0.6$ scin

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

γ Co^{59}(n,?γ) $E_n = 3.2$ scin

0.20†	0.60	0.15†	1.7
0.82†	1.15	0.19†	2.5
0.53†	1.49		

†σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Co^{60}
27 33
5.2^y

$|\mu|$ 4.3 *2** $\gamma(\theta, T)$; scin
($\sim$1.2γ)(θ,T) J = 4, 2, 0
*Assuming J(Co^{60})g.s. = 5

O.J.Poppema, M.J.Steenland, J.A.Beun, C.J. Gorter, Physica 21, 233 (1955).

β^- 0.309 *3* sl
F-K plot linear above 0.056

G.Bolla, S.Terrani, L.Zappa, Nuovo Cim. 12, 875 (1954).

No delayed $\beta\gamma$ ($\tau_\gamma < 500^{\mu\mu s}$)

V.Z.Wintersteiger, Bull. Inst. Nuclear Sci., Boris Kidrich 4, 79 (1954).

$\beta\gamma$ and $\gamma\gamma$ delay $< 10^{\mu\mu s}$ scin

Z.Bay, V.P.Henri, F.McLernon, Phys. Rev. 97, 561 (1955); 94, 780A (1954).

(1.17γ)(1.33γ)(θ) J = 4, 2, 0 Both γ's E2
$\eta(\pi) = 0.1667$ *12* scin

S.Colombo, A.Rossi, A.Scotti, Nuovo Cim. 2, 471; 1, 522 (1955).

$\gamma\gamma(\theta)$ from paramagnetic crystal source same at 288°K and 20°K

H.R.Lemmer, N.A.Grace, Proc. Phys. Soc. 67A, 1051 (1954).

Co^{60}
27 33
5.2^y

Levels Co^{59}(d,p) $E_d = 5$
g.s. Q = 5.283 *8* sπ 90°

0.060	*3*	2.610	*6*
0.286	*3*	2.624	*6*
0.445	*3*	2.786	*9*
0.513	*3*	2.870	*13*
0.557	*5*	2.924	*9*
0.622	*4*	3.038	*9*
0.792	*3*	3.120	*9*
1.012	*3*	3.138	*9*
1.237	*5*	3.208	*9*
1.394	*4*	3.288	*9*
1.533	*6*	3.304	*9*
1.663	*6*	4.221	*9*
1.825	*6*	4.302	*10*
2.005	*6*	4.421	*10*
2.065	*6*	4.494	*13*
2.154	*6*	4.533	*13*
2.295	*6*	4.571	*13*
2.370	*13*		

G.M.Foglesong, D.G.Foxwell, Phys. Rev. 96, 1001 (1954).

Resonances Co^{59}(n) E_n = 2 to 100 kev
E_0 (kev) Li(p,n)
5.4
7.8
28.3

H.Marshak, H.W.Newson, Phys. Rev. 98, 1162A (1955).

Ni
28

γ Ni(n,?γ) $E_n = 3.2$ scin

0.05†	0.59	0.54†	1.49
0.84†	1.33	0.01†	2.7

†σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Ni^{54}
28 26
$<5^m$

Not observed from Ni(98-Mev p) chem; $\tau < 5^m$

R.W.Fink, Thesis, Univ. of Rochester (1953).

Ni^{55}
28 27
$<5^m$

Not observed from Ni(98-Mev p) chem; $\tau < 5^m$

R.W.Fink, Thesis, Univ. of Rochester (1953).

Ni^{58}
28 30
stable

Level Ni^{58}(p,p') E_p = 4.6 to 5.7 sπ
1.453 *5*

J.P.Schiffer, F.W.Windham, C.R.Gossett, G.C. Phillips, Phys. Rev. 99, 655A (1955).

Ni^{59}
28 31
7.5×10^{4} y

Resonances $Ni^{58}(n)$ $E_n = 2$ to 270 kev

	E_o (kev)		E_o (kev)	Li(p,n)
	5	st	162	
st	17		192	
st	65	st	211	
	109		236	
	124		No peak at 229 kev*	
st	142			

R.C.Block, H.W.Newson, Phys. Rev. 98, 1162A (1955); *priv. comm.

Resonances $Ni^{58}(n)$ $E_n = 1$ to 160 kev

E_o (kev)	J	l	Γ(kev)
16	1/2	0 or 1	~2
65	1/2	0	2.9
144	1/2	0	~4
160	1/2	0	~4

C.T.Hibdon, A.Langsdorf, Phys. Rev. 98, 223A (1955); verbal report.

Ni^{60}
28 32
stable

Level $Ni^{60}(p,p')$ $E_p = 4.6$ to 5.7 sπ
1.329 *5*

J.P.Schiffer, P.M.Windham, C.R.Gossett, G.C. Phillips, Phys. Rev. 99, 655A (1955).

Ni^{61}
28 33
stable

Resonances $Ni^{60}(n)$ $E_n = 2$ to 270 kev

	E_o (kev)		E_o (kev)	Li(p,n)
st	15		140	
st	30		162	
st	67	st	188	
	88	st	200	
	99		257	
	104			

R.C.Block, H.W.Newson, Phys. Rev. 98, 1162A (1955).

Ni^{66}
28 38
56 h

β⁻ 0.3 Ta^{181}(340-Mev p); a

W.E.Nervik, G.T.Seaborg, Phys. Rev. 97, 1092 (1955).

Cu
29

Levels Cu(n,n′) $E_n = 2.5$
1.0 pc
1.40 *12*

Geneva Conf. 8/P/714 (1955), M.V.Pasechnik (USSR).

γ Cu(n,n′γ) $E_n = 3.2$ scin

0.21†	0.66	0.81†	1.37
0.12†	0.96	0.16†	1.9

†σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Cu^{57}?
29 28

τ 0.18^{s} Ni(50-Mev p)
See also Co^{54}

H.Tyrén, P.A.Tove, Phys. Rev. 96, 773(1954).

Cu^{58}?
29 29

τ 9.5^{m} *2* Ni^{58}(5.5-Mev d,2n)
β^{+} < 0.7 sπ

T.Yuasa, M.E.Nahmias, M.Vivargent, J. phys. radium 16, 654 (1955).

Cu^{58}
29 29
3.0^{s}

τ 3^{s} Ni(23-Mev p)

H.Tyrén, P.A.Tove, Phys. Rev. 96, 773 (1954).

Cu^{59}
29 30
81^{s}

$Ni^{(58)}$(5-Mev d,n); chem
τ 81^{s} *2*
β^{+} 3.4 *5* a
γ 0.88 *2* scin
1.31 *2*
No 0.33γ, 0.4γ, 0.42γ
At least 2 other γ's with $1.5 < E_\gamma < 3$

L.Lindner, G.A.Brinkman, A.C.Pieterse, Physica 21, 745 (1955).

τ 83^{s} *1* Ni^{58}(5.5-Mev d,n)
β^{+} 100+ 1.85 *5* sπ
γ ≤2+ ~1.75 scin
No γ with $0.08 < E_\gamma < 0.45$ (<0.2+)

T.Yuasa, M.E.Nahmias, M.Vivargent, J. phys. radium 16, 654 (1955).

Cu^{62}
29 33
10^{m}

No γ $Cu^{(63)}$(< 25-Mev γ,n)
$\gamma(0.1 \leq E_\gamma \leq 1.2) < 0.5\%$ of $\gamma^{\pm}$ scin
No (0.56 γ) $\gamma^{\pm}$ Σscin
No γ with $E_\gamma > 1.2$ scin

J.M.Reid, I.F.Wright, Nature 175, 298 (1955).

Cu^{63}
29 34
stable

μ +2.220586 I
$\nu(Cu^{63})/\nu(Na^{23}) = 1.002008$ *16*

H.E.Walchli, ORNL-1775 (1954).

q −0.16 *3* para

B.Bleaney, K.D.Bowers, M.H.L.Pryce, Proc. Roy. Soc. 228A, 166 (1955).

Levels $Cu^{63}(p,p')$ $E_p = 4.6$ to 5.7 sπ

0.669 *5*	1.410 *5*
0.968 *5*	1.549 *5*
1.326 *5*	

J.P.Schiffer, P.M.Windham, C.R.Gossett, G.C. Phillips, Phys. Rev. 99, 655A (1955).

Cu^{63}
29 34
stable

Level $Cu^{63}(p,p'\gamma)$ $E_p > 2.2$; γ scin
0.67 *2*

C.E.Weller, J.C.Grosskreutz, Phys. Rev. 99, 655A (1955); priv. comm.

Levels $Cu^{(63)}(\alpha,\alpha'\gamma)$ $E_\alpha = 7$; γ scin
0.690 *11* $\epsilon B(E2) = 0.017$
0.990 *15* $\epsilon B(E2) = 0.069$

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 100, 961A (1955); priv. comm.

$Cu^{(63)}(\gamma,n)$ $E_\gamma = 17.55$ to 17.67
Structure in giant resonance observed from yield of 10^mCu

D.P.Bunbury, Proc. Phys. Soc. 67A, 1106 (1954).

Cu^{64}
29 35
13^h

τ 12.80^h *3* differential ic

J.Tobailem, J. phys. radium 16, 48 (1955).

$Cu^{(63)}$(polarized th n,γ)
The compound nucleus has J = 2 from left circular polarization of g.s. 7.91γ

G.Trumpy, Nature 176, 507 (1955).

Cu^{65}
29 36
stable

μ +2.378967 I
$\nu(Cu^{65})/\nu(H^1) = 0.283954$ *4*

H.E.Walchli, ORNL-1775 (1954).

Q −0.15 *3* para-

B.Bleaney, K.D.Bowers, M.H.L.Pryce, Proc. Roy. Soc. 228A, 166 (1955).

$Cu^{65}(p,p')$ $E_p = 4.6$ to 5.7 $s\pi$
No levels observed below 1.5

J.P.Schiffer, P.M.Windham, C.R.Gossett, G.C. Phillips, Phys. Rev. 99, 655A (1955).

Zn
30

γ Zn(n,?γ) $E_n = 3.2$ scin

1.3†	1.02
0.03†	1.3
0.02†	1.6

†σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Zn^{60}
30 30
2.1^m

Ni^{58}(52-Mev α,2n) chem
τ 2.1^m *1* p 23^mCu
Weak γ's with $0.5 < E_\gamma < 3$ due to Zn^{60}, Zn^{61} ?
Not produced by Ni^{58}(15-Mev α,2n)

L.Lindner, G.A.Brinkman, Physica 21, 747 (1955).

Zn^{61}
30 31
1.5^m

τ 1.5^m *1* Ni^{58}(18-Mev α,n) chem
β^+ 4.9 *5* scin
No strong γ scin
p 3.3^hCu

J.B.Cumming, Phys. Rev. 99, 1645A (1955).

Ni^{58}(15-,52-Mev α,n) chem
τ 1.48^m *3* p 3.3^hCu
β^+ 4.8 *3* a
See also Zn^{60}

L.Lindner, G.A.Brinkman, Physica 21, 747 (1955).

Zn^{64}
30 34
stable

Level $Zn^{64}(\alpha,\alpha'\gamma)$ $E_\alpha = 7$ γ scin
1.00 $\tau = 1^{\mu\mu s}$ ($\alpha = 3 \times 10^{-4}$)

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 100, 961A (1955); priv. comm.

$Cu^{63}(p,\gamma)$ $E_p = 1.9$

γ	31+	0.78 *2*	40+	2.07 *2*	scin
	100+	0.97 *2*	40+	2.27 *2*	
	17+	1.16 *2*		3.84 ?	
	29+	1.30 *2*		5.64	

Many others with $5.6 < E_\gamma < 10$
(0.97 γ)(0.78 γ, 1.16 γ, 1.30 γ, 2.07 γ, 2.4? γ)

C.E.Weller, J.C.Grosskreutz, Phys. Rev. 99, 655A (1955); priv. comm.

$Zn^{(64)}(\gamma,n)$ $E_\gamma = 17.55$ to 17.67
Possible structure in giant resonance from yield of 38^mZn

D.P.Bunbury, Proc. Phys. Soc. 67A, 1106 (1954).

Zn^{65}
30 35
245^d

$Zn^{(64)}$(polarized th n,γ)
Left circular polarization of 7.88γ studied; the terminal level of the γ transition has J = 3/2, 5/2 for dipole, quadrupole radiation

G.Trumpy, Nature 176, 507 (1955).

Zn^{66}
30 36
stable

Level $Zn^{(66)}(\alpha,\alpha'\gamma)$ $E_\alpha = 7$; γ scin
1.04 $\tau = 1.0^{\mu\mu s}$ ($\alpha = 2 \times 10^{-4}$)

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 100, 961A (1955); priv. comm.

Zn^{66} $Cu^{65}(p,\gamma)$ $E_p = 1.9$
30 36 γ 0.83 *2*   2.75 *2*   scin
stable   1.04 *2*   3.76 *2*
1.37 *2*   4.12 *2*
2.17 *2*   4.33 *2*
2.41 ?   4.52 *2*
Many others with $4.5 < E_\gamma < 10$
$(1.04\gamma)(0.83\gamma, 1.03\gamma, 1.37\gamma, 2.17\gamma, 2.75\gamma)$
No 3.41 γ

C.E.Weller, J.C.Grosskreutz, Phys. Rev. 99, 655A (1955); priv. comm.

Zn^{67} $Zn^{67}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.5$
30 37 γ 0.092* (2 unresolved γ's)   scin
stable   0.182 $\epsilon B(E2) = 0.043$
*Excitation function shows γ's emitted from 0.182 level

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 96, 426 (1954); 93, 351 (1954).

Zn^{69} β^- 100%   0.914   d 14^hZn;   sl
30 39
51^m
g.s.

A.B.Smith, Dissertation Abstr. 13,849(1953).

β^- 0.85 $Zn^{(68)}(\text{th } n,\gamma)$; a
No γ scin

J.M.LeBlanc, J.M.Cork, S.B.Burson, Phys. Rev. 97, 750 (1955).

Levels $Zn^{68}(d,p)$ $E_d = 11.9$ scin
100†   g.s.   Q = 4.16 *15* $l_n = 1$ d,p(θ)
40†   (0.435) $l_n = 4$
125†   0.77 $l_n = 2?$
1.6
†Relative numbers at forward peaks

F.S.Eby, Phys. Rev. 96, 1355 (1954); 93, 925A (1954).

Zn^{69} γ 0.435 $\alpha = 0.053$ M4   sl
30 39
14^h

A.B.Smith, Dissertation Abstr. 13,849(1953).

γ 0.435 $Zn^{(68)}(\text{th } n,\gamma)$
No other γ No $\beta\gamma$ scin

J.M.LeBlanc, J.M.Cork, S.B.Burson, Phys. Rev. 97, 750 (1955).

Zn^{71} τ 2.2^m $Zn^{70}(\text{pile } n,\gamma)$
30 41 β^- 2.4 *2* $a\beta\gamma$, a
2.2^m
g.s. γ 0.12   scin
0.51*
w   0.90
w   1.09
*Not same as 0.49 γ of 3^hZn ($\Delta E_\gamma = 0.03$)
$(2.4\beta)(0.51\gamma)$ $\beta(0.12, 0.51, 0.90, 1.09\gamma)$
No $(0.12\gamma)(0.51\gamma)$

J.M.LeBlanc, J.M.Cork, S.B.Burson, Phys. Rev. 97, 750 (1955); 94, 1436A (1954).

Zn^{71} τ 3^h $Zn^{70}(\text{pile } n,\gamma)$
30 41 β^- 1.5 $a\beta\gamma$
3^h γ 0.38   scin $\beta\gamma$
0.49*   scin $\beta\gamma$
0.61   scin $\beta\gamma$
*Not same as 0.51 γ of 2.2^mZn ($\Delta E_\gamma = 0.03$)
$(1.5\beta)(0.38\gamma, 0.49\gamma, 0.61\gamma)$
All three γ's in cascade   scin $\gamma\gamma$

J.M.LeBlanc, J.M.Cork, S.B.Burson, Phys. Rev. 97, 750 (1955); 94, 1436A (1954).

Ga $\mu(Ga^{71})/\mu(Ga^{69}) = 1.2706242$ *20*   para
31

M.Rice, R.V.Pound, Phys. Rev. 99, 1036 (1955)

Ga^{67} $Zn^{(66)}$(26-Mev d,n)   chem
31 36 γ scin
78^h

5+	(0.090)	15+	0.388
95+	(0.092)	0.5+	0.485 *?*
54+	(0.182)	0.2+	0.595 *10*
~0.2+	0.20 *1*	~0.2+	0.690 *10*
5.3+	(0.206)	~0.2+	0.780 *10*
49+	0.296	0.45+	0.870 *10*

$(\sim 0.2\gamma)(0.090\gamma, \sim 0.2\gamma, 0.296\gamma, 0.388\gamma, 0.485\gamma)$
$(\sim 0.3\gamma)(\sim 0.20\gamma, 0.485\gamma)$
$(\sim 0.4\gamma)(\sim 0.20\gamma, 0.485\gamma)$
$(\sim 0.2\gamma)(\sim 0.2\gamma)(\theta)$ indicates J = 3/2, 5/2, 5/2 if both γ's M1
Assuming the 0.296 γ to be pure M1, the 0.485 has < 0.5% E2 and J = 3/2, 3/2, 3/2 from $(0.485\gamma)(0.296\gamma)(\theta)$
$(0.296\gamma)(0.092\gamma)$ delay = $9.3 \pm 0.2^{\mu s}$ scin

L.H.T.Rietjens, H.J.Van den Bold, Physica 21, 701 (1955).

Ga^{69} μ +2.010809   I
31 38 $\nu(Ga^{69})/\nu(Na^{23}) = 0.907349$ *20*
stable

H.E.Walchli, ORNL-1775 (1954).

Ga^{69}
31 38
stable

$|\mu_3|$ 0.11 *2* M
Interaction constant = 84 ± 6 cps

R.T.Daly, Jr., J.H.Holloway, Phys. Rev. 96, 539 (1954).

Ga^{71}
31 40
stable

μ +2.554922 I
$\nu(Ga^{71})/\nu(Na^{23}) = 1.152872$ *8*

H.E.Walchli, ORNL-1775 (1954).

$|\mu_3|$ 0.15 *2* M
Interaction constant = 115 ± 7 cps

R.T.Daly, Jr., J.H.Holloway, Phys. Rev. 96, 539 (1954).

Ga^{72}
31 41
14.1^h

β^-	42%	0.637	9%	2.529	s
	31%	0.959	8%	3.166	
	10%	1.508			
γ	7+	0.601	4+	1.463	scin
	21+	0.630	6+	1.595	
	*	0.690	6+	1.859	
	3+	0.768	30+	2.203	
	3+	0.810	10+	2.491	
	93+	0.834	17+	2.508	
	10+	0.894	0.4+	2.827	
	7+	1.050	0.04+	3.086	
	2+	1.317	0.02+	3.350	

+ Photons/100 β^- *No photon, ce_K only

M.W.Johns, B.C.Chidley, I.R.Williams, Phys. Rev. 99, 1645A (1955).

Ge
32

γ Ge(n,n'γ) $E_n = 4.4$

	E_γ	A	
47+	0.51*	?	scin
100+	0.61	74	
66+	0.84	72	
42+	1.05	70	
~9+	1.25	74?	

$*\tau < 0.3^s$

R.M.Sinclair, Phys. Rev. 99, 621A (1955); verbal report.

Ge^{70}
32 3[illegible]
stable

Level $Ge^{70}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.5$; scin
γ 1.020 *15* $\tau = 1.4^{\mu\mu s}$

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 99, 617A (1955); verbal report.

Level $Ge^{(70)}(n,n'\gamma)$ $E_n = 4.4$
γ 1.06 scin

R.M.Sinclair, Phys. Rev. 99, 621A (1955); verbal report.

Ge^{71}
32 39
11.4^d

τ 12.5^d *1* $Ge^{(70)}$(pile n,γ),chem
E_ϵ 0.231 *3* γ continuum, scin

A.Bisi, E.Germagnoli, L.Zappa, E.Zimmer, Nuovo Cim. 2, 290 (1955).

Ge^{71}
32 39
11.4^d

$e_A(L)/e_A(K) = 1.26$ pc
$\epsilon_L/\epsilon_K = 0.30$, 0.22 or (0.11 theory) for fluorescence yield 0.45^*, 0.49^{**} or 0.54 resp.

M.Langevin, Compt. rend. 239, 1625 (1954); *Burhop, The Auger Effect, Camb. Univ. Press p. 48 (1952); **Broyles, Thomas, Haynes, Phys. Rev. 89, 723 (1953).

Ge^{72}
32 40
stable

Level $Ge^{(72)}(n,n'\gamma)$ $E_n = 4.4$
γ 0.84 scin

R.M.Sinclair, Phys. Rev. 99, 621A (1955); verbal report.

Level $Ge^{72}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; scin
γ 0.830 *13* $\tau = 1.3^{\mu\mu s *}$

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 99, 617A (1955); *verbal report.

Ge^{73}
32 41
stable

Level $Ge^{73}(\alpha,\alpha'\gamma)$ $E_\alpha = 3.5$
γ 0.068 $\epsilon B(E2) = 0.042$ scin
No 0.014 γ or 0.054 γ observed

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 96, 426 (1954); 93, 351 (1954); 95, 629A (1954).

Ge^{74}
32 42
stable

Level $Ge^{74}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; scin
γ 0.593 *9* $\tau = 9.0 \times 10^{-12} s^*$

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 99, 617A (1955); *verbal report.

Level $Ge^{(74)}(\gamma,\gamma)$ As^{74} vapor
γ (0.596) J = 2 $\gamma\gamma(\theta)$
$\tau = 17^{\mu\mu s}$ σ

F.R.Metzger, Phys. Rev. 99, 613A (1955).

Level $Ge^{(74)}(n,n'\gamma)$ $E_n = 4.4$
γ 100+ 0.61 scin
~9+ 1.25*
*Assigned from systematics (Phys. Rev. 98, 214)

R.M.Sinclair, Phys. Rev. 99, 621A (1955); verbal report.

Ge^{75}
32 43
82^m
g.s.

β^-		~0.72	$Ge^{74}(n,\gamma)$		scin $\beta\gamma$
	11.4%	0.919 *20*			
		0.975 *20*			
		1.188 *20*			
γ	22+	0.066	25+	0.427 *5*	scin
	120+	0.199	23+	0.477 *10*	
	1000+	0.264 *4*	18+	0.628 *5*	

$(\sim 0.72\beta)(0.477\gamma)$ $(0.975\beta)(0.199\gamma)$ scin
$(0.919\beta)(0.265\gamma)$ No $(1.188\beta)\gamma$
$(0.199\gamma)(0.066\gamma$, $0.427\gamma)$
No 0.121γ, 0.136γ (< 1.5+)
No 0.402γ (< 0.3+)

A.W.Schardt, J.P.Walker, Phys. Rev. 99, 810 (1955).

Ge^{75}
32 43
49^s

τ 49^s *2* Ge^{74}(pile n,γ)
γ 0.1385 *10* K/LM > 3 sτ ce, scin

S.B.Burson, W.C.Jordan, J.M.LeBlanc, Phys. Rev. 96, 1555 (1954); 95, 613A (1954).

Ge^{76}
32 44
stable

Level Ge^{76}(α,α'γ) $E_α$ = 6.0; scin
γ 0.566 *9* τ = $11^{µs}$

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 99, 617A (1955); verbal report.

Ge^{77}
32 45
12^h
g.s.

β⁻ ~1.3 Ge^{76}(pile n,γ) a βγ
~1.5 a βγ
2.1 a βγ

γ	0.210 *1*	0.91 *2*	scin
	0.215 *3*	1.09 *2*	
	0.265 *1*	1.19 *2*	
	0.365 *7*	1.36 *3*	
	0.410 *8*	(1.46)*	
	0.560 *10*	(1.54)*	
	0.625 *15*	1.75 *3*	
	0.710 *15*	2.00 *5*	
	0.79 *2*	2.30 *5*	

*Unresolved

$γ_a$\\$γ_b$	~0.21	0.265	0.365	0.410	0.560	0.625
0.210		Y				
0.215				Y		
0.265	Y		Y		Y	
0.365		Y			Y	
0.410	Y	N	N		Y	
0.560	Y	Y	Y	Y		
0.625					Y	
0.79		Y	Y	Y	Y	Y
0.91	Y	Y	Y	Y	N	Y ?
1.19	N	Y	N		N	N
1.36		Y	Y	Y	N	Y
1.75						Y

Coincidences observed (Y) and not observed (N) between $γ_b$ and indicated $γ_a$

No 0.300 γ, 0.327 γ, 0.428 γ, 0.466 γ
No 2.75 γ (Na^{24} impurity)
(~1.3 β) (1.09 γ) (~1.5 β) (0.56 γ)
(2.1 β) (~0.21 γ, 0.265 γ, 0.365 γ, 0.410 γ)
(1.09 γ) γ delay > $1.6^{µs}$

S.B.Burson, W.C.Jordan, J.M.LeBlanc, Phys. Rev. 96, 1555 (1954); 95, 613A (1954).

Ge^{77}
32 45
52^s

τ 52^s *2* Ge^{76}(pile n,γ)
β⁻ 10* ~2.7 a βγ
90* (2.9) scin
γ 100† 0.159 *3*
100† 0.215 *3*
(~2.7 β) (0.215 γ) No β(0.159 γ)
No (0.159 γ) (0.215 γ) *2.7 β/2.9 β = 1/9

S.B.Burson, W.C.Jordan, J.M.LeBlanc, Phys. Rev. 96, 1555 (1954); 95, 613A (1954).

$As^?$
33

τ 27^m Se(fast n) chem
Possibly Se but not Ge activity

C.Ythier, G.Herrmann, Z. Elektrochem 58, 630 (1954).

$As^{68?}$
33 35

τ ~7^m $Ge^{(70)}$(≥40-Mev p,3n) chem

F.D.S.Butement, E.G.Prout, Phil. Mag. 46, 357 (1955).

As^{69}
33 36
15^m

τ 15^m $Ge^{(70)}$(≥20-Mev p,2n) chem
β⁺ 2.9 a
No other β⁺
γ 0.23 scin
No other γ p 40^hGe chem

F.D.S.Butement, E.G.Prout, Phil. Mag. 46, 357 (1955).

As^{70}
33 37
52^m

τ 47^m *2* Cu(125-Mev N^{14}) chem
β⁺ 67† 1.35 *3* F-K linear sτ
33† 2.45 *4* F-K linear
γ 1.07 *4*
Other peaks at 1.5, 2.15, 2.75, 3.25

A.E.Souch, Proc. Phys. Soc. 68A, 760 (1955).

γ 0.18 $Ge^{(70)}$(8-Mev p,n) chem
1.06 1.74 scin
1.36 2.04

F.D.S.Butement, E.G.Prout, Phil. Mag. 46, 357 (1955).

As^{71}
33 38
62^h

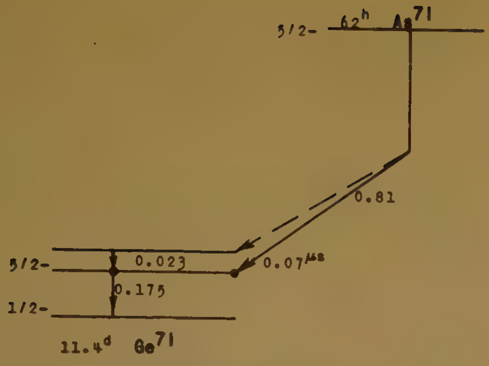
τ 62^h *3* Ge^{70}(11-Mev d,n) chem
β⁺ 0.815 *10* sl
γ ~2.3* 0.02300 *5* K/LM ~1 sl ce
23* 0.1750 *3* K : L : M = 31 : 4 : 1
$α_K$ = 0.095 E2
$γ^±$(0.175 γ) delay = $0.07^{µs}$
*ce per 100 β⁺

W.E.Graves, A.C.G.Mitchell, Phys. Rev. 97, 1033 (1955).

τ 65^h *5*
$Ge^{(70)}$(25-Mev d,n) chem; ms
β⁺ 3† 0.25 ? sl
97† 0.813 *10*
15* 0.0233 *3* K/LM = 5.4 sl ce
21* 0.1745 *4* K/LM = 8.9 sd ce
vw 0.535 *40* ? scin
$ε_K/β^+$ = 2.1 ± 1.0 from $e_A/β^+$ = 1.5
(0.813 β)(0.175 γ) sl
(ce_K 0.023 γ)(0.175 γ) sl
*ce per 100 β⁺

(Continued)

As^{71}
33 38
62^h



S.Thulin, J.Moreau, H.Atterling, Arkiv Fysik 8, 219 (1954).

As^{75}
33 42
stable

Levels	$As^{75}(\alpha,\alpha'\gamma)$	$E_\alpha = 7$ $\epsilon B(E2)$	γ scin
	0.200 *3*	0.012	
	0.283 *5*	0.049	
	0.574 *8*	0.10	
	0.814 *13*	0.13	

No 0.068γ

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 100, 961A (1955); priv. comm.

As^{76}
33 43
26.5^h

β^-	2.5%	0.36		sl
	16.0%	1.76		
	31.0%	2.41		
	50.5%	2.965 *10*	$\Delta J = 2$, yes shape	
γ	100+	0.549 *4*		scin, sl pe
	20+	0.643 *6*		
	21+	1.200 *6*		
	2+	1.402 *15*		
	4+	2.053 *18*		

(1.76β)(1.20γ)   (2.41β)(0.55γ)   scin
(0.55γ)(0.64γ, 2.05γ, 1.4γ?)   scin
(1.20γ)(1.40γ)   No γ ($1.7 < E_\gamma < 1.8$)

J.D.Kurbatov, B.B.Murray, M.Sakai, Phys. Rev. 98, 674 (1955).

As^{77}
33 44
38.7^h

τ	38.7^h *5*	$Br^{(81)}(\gamma,\alpha)$	chem

J.Schmouker, P.Erdös, P. Jordan, P.Stoll, J. phys. radium 16, 169 (1955).

			$As^{(76)}$(pile n,γ)	chem
γ	0.13+	0.086 *1*		scin
	0.26+	0.160 *5*		
	2.5+	0.245 *2*		
	0.8+	0.525 *5*		

No γ with $0.02 < E_\gamma < 0.08$ (< 0.2+)
0.033 γ attributed to iodine escape peak
0.020 γ attributed to external bremsstrahlung
No (0.086γ)($0.08 < E_\gamma < 0.7$)
No (0.160γ)($0.03 < E_\gamma < 0.4$)   (0.245γ)(0.270γ?)
+Photons per 100 disintegrations

H.Langevin, J. phys. radium 16, 238 (1955).

As^{77}
33 44
38.7^h

					d 12^hGe
γ	11+	0.086	100+	0.243	scin
	5+	0.161	31+	0.525	

No 0.282γ (< 0.1+)
No γ with $0.020 < E_\gamma < 0.030$ pc

A.Bisi, E.Germagnoli, L.Zappa, E.Zimmer, Nuovo Cim. 2, 290 (1955).

As^{79}
33 46
9^m

τ	9.1^m	Se(fast n)	chem
		p 3.9^mSe	chem

C.Ythier, G.Herrmann, Z. Elektrochem. 58, 630 (1954).

$As^{80?}$
33 47

τ	$\sim 36^s$	$Se^{(80)}$(fast n,p)	chem

C.Ythier, G.Herrmann, Z. Elektrochem. 58, 630 (1954).

Se^{73}
34 39
7.1^h

			$Ge^{(70)}$(30-Mev α,n)		chem
β^+	100+*	1.29 *1*			
	≤ 1+*	1.65 *1*			sl
γ	29.8**	0.0659 *2*	K/LM = 10.2	M1	sl ce
			$\tau < 0.005^{\mu s}$		$\gamma\gamma$
	1.4**	0.359 *1*	$\tau = 6.0^{\mu s}$	M2	$\gamma^{\pm}\gamma$

No 0.86γ, 1.31γ (< 1%)   scin
(0.359γ)(0.066γ) $\gamma^{\pm}$(0.066γ, 0.359γ)
*$6^{\mu s}$ delay for ≥ 99% of $\gamma^{\pm}$ (0.066γ)
**ce per 100 β^+

R.W.Hayward, D.D.Hoppes, Phys. Rev. 98, 1172A. (1955); verbal report.

Se^{74}
34 40
stable

Level	$Se^{74}(\alpha,\alpha'\gamma)$	$E_\alpha = 7$	γ scin
	0.635 *10* $\tau = 8^{\mu\mu s}$		(α = 0.001)

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 100, 961A (1955); priv. comm.

Se^{75}
34 41
127^d

		As^{75}(22-Mev d, 2n)	chem
J	5/2	OCSe^{75}	Mic
q	+1.1 *2*		

$q(Se^{75})/q(Se^{79}) = 1.2578$ *6*

L.C.Aamodt, P.C.Fletcher, Phys. Rev. 98, 1224 (1955); 94, 789A (1954).

			α_K	$Se^{(74)}$(n,γ)
γ		0.0244		sπ ce,
	~ 2+	0.0663	~ 0.6	sl pe, scin
		0.0812	?	
	7+	0.0969	~ 1.8	E2/M1 $\gamma\gamma(\theta)$
	28+	0.1211	0.10	~ 0.2
	94+	0.1361	0.07	~ 0.2
	~ 3+	(0.199)	~ 0.03	
	100+	(0.265)	0.016	~ 4
	46+	(0.280)	0.019	≥ 4
	2+	(0.305)	~ 0.03	
	25+	(0.402)	0.0024	
x	81+	K x ray		

No 0.0767γ (< 0.6%)   sπ pe, ce
No ϵ to g.s. (< 20%)

(Continued)

Se^{75}
34 41
127^d

(0.066γ)(K x ray, 0.136γ, 0.199γ)
(0.097γ)(K x ray, 0.280γ ?, 0.305γ ?)
(0.121γ)(K x ray, 0.280γ)
(0.136γ)(K x ray, 0.265γ) No $(0.402\gamma)\gamma$
(K x ray) (0.199γ, 0.265γ, 0.280γ, 0.402γ)
$(0.121\gamma)(0.280\gamma)(\theta)$ J = 3/2, 5/2(or 3/2), 3/2
$(0.136\gamma)(0.265\gamma)(\theta)$ J = 3/2, 3/2(or 1/2), 3/2
Delay $< 10^{-9s}$ for
(ce 0.097γ)(ce $\sim 0.29\gamma$) and scin
(ce $\sim 0.13\gamma$)(ce $\sim 0.29\gamma$)

A.W.Schardt, J.P.Welker, Phys. Rev. 99, 810 (1955).

Highest energy sum peak at 0.405 is strongest
$(0.138\gamma)(0.269\gamma)$ No $(0.098\gamma)\gamma$ Σ scin
No $(0.077\gamma)(0.269\gamma)$ Possible $(0.124\gamma)\gamma$

D.C.Lu, W.H.Kelly, M.L.Wiedenbeck, Phys. Rev. 97, 139 (1955).

Se^{76}
34 42
stable

Level $Se^{76}(\alpha,\alpha'\gamma)$ $E_\alpha = 7$ γ scin
0.567 *9* $\tau = 8^{\mu\mu s}$ (α = 0.002)

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 100, 961A (1955); priv. comm.

Se^{77}
34 43
stable

μ +0.5324786 I
$\nu(Se^{77})/\nu(H^2) = 1.242100$ *19*

H.E.Walchli, ORNL-1775 (1954).

γ $Se^{77}(\alpha,\alpha'\gamma)$ $E_\alpha = 7$ γ scin
0.086
0.160 Not excited directly
0.211
0.244 $\epsilon B(E2) = 0.12$
0.457 $\epsilon B(E2) = 0.33$
$(0.211\gamma)(0.244\gamma)$ $\alpha(0.244\gamma)(\theta)$ isotropic
$\alpha(0.457\gamma)(\theta)$ favors J = 5/2 for 0.457 level

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 100, 961A (1955); priv. comm.

Se^{78}
34 44
stable

Level $Se^{78}(\alpha,\alpha'\gamma)$ $E_\alpha = 7$ γ scin
0.615 *10* $\tau = 8^{\mu\mu s}$ (α = 0.001)

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 100, 961A (1955); priv. comm.

Se^{79}
34 45
3.9^m

τ 3.91^m *5* $Br^{(79)}$(fast n,p) chem

C.Ythier, G.Herrmann, Z. Elektrochem. 58, 630 (1954).

Se^{80}
34 46
stable

Level $Se^{80}(\alpha,\alpha'\gamma)$ $E_\alpha = 7$ γ scin
0.654 *11* $\tau = 8^{\mu\mu s}$ (α = 0.001)

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 100, 961A (1955); priv. comm.

Se^{81}
34 47
18^m
g.s.

τ 18.2^m *2* d 57^mSe chem

C.Ythier, G.Herrmann, Z. Elektrochem. 58, 630 (1954).

Se^{81}
34 47
57^m

τ 56.8^m *2* $Br^{(81)}$(fast n,p) chem

C.Ythier, G.Herrmann, Z. Elektrochem. 58, 630 (1954).

γ ~0.100 K/L = 4.0 ± 0.2 s ce
α_K = 8.6 ± 2.4 E3?

G.M.Drabkin, L.I.Rusinov, Doklady Akad. Nauk SSSR 97, 417 (1954).

Se^{82}
34 48
stable

Level $Se^{82}(\alpha,\alpha'\gamma)$ $E_\alpha = 7$ γ scin
0.880 *13* $\tau = 4^{\mu\mu s}$ ($\alpha = 5 \times 10^{-4}$)

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 100, 961A (1955); priv. comm.

Br
35

Abundances
Br^{79} 50.56% $Br^{79}/Br^{81} = 1.0217$ *2*
Br^{81} 49.44%
Ratio same in samples from 5 geological sources

A.E.Cameron, E.L.Lippert, Jr., Science 121, 136 (1955).

Br^{76}
35 41
17^h

τ 17.5^h Kr^{76} source
γ 0.20 ? 0.85 ? scin
0.56 ~1.2 (double)
0.66
A 1.86 γ with $\tau \sim 30^h$ was observed in a ms sample of Kr^{76} (+Br^{76})

S.Thulin, Arkiv Fysik 9, 137 (1955).

Br^{79}
35 44
stable

μ +2.098991 I
$\nu(Br^{79})/\nu(Na^{23}) = 0.947140$ *9*

H.E.Walchli, ORNL-1775 (1954).

$q(Br^{79})/q(Br^{81}) = 1.1973$ *6* M

B.P.Fabricand, R.O.Carlson, C.A.Lee, I.I. Rabi, Phys. Rev. 91, 1403 (1953).

Br^{81}
35 46
stable

μ +2.262597 I
$\nu(Br^{81})/\nu(Na^{23}) = 1.020965$ *14*

H.E.Walchli, ORNL-1775 (1954).

Kr^{76}
36 40
9.7^h

$Br^{(79)}$(60-Mev p,4n) chem;ms

τ	$\sim 10.5^h$		
γ	0.028	0.316	scin
	0.093	0.40	
	0.267		
No β^+			scin

S.Thulin, Arkiv Fysik 9, 137 (1955).

Kr^{77}
36 41
1.1^h

$Br^{(79)}$(50-Mev p,3n) chem; ms

τ		1.2^h		
β^+	7+	0.85		sl
	32+	1.67		
	61+	1.86		
			K/LM	
γ	~36*	0.0242 *5*	1.3	sl ce
	100*	0.1076 *8*	3.6	
	45*	0.1311 *10*	8.2	
	26*	0.1493 *10*	~5	
	~0.2*	0.246 *3*		
	~0.2*	0.281 *3*		
	~0.4*	0.313 *1*		
		0.665		scin
		0.870		

$(0.665\gamma)(ce_K\ 0.1312\gamma,\ ce_K\ 0.149\gamma, \sim 0.14\gamma)$
No $(0.665\gamma)(ce_K\ 0.108\gamma)$
$\epsilon_K/\beta^+ = 0.2$
*ce_K per 1000 β^+

S.Thulin, Arkiv Fysik 9, 137 (195

Kr^{79}
36 43
34.5^h

$Br^{(79)}$(25-Mev d,2n) chem; ms

β^+	~7+	0.325 *20*				sl
	93+	0.598 *5*	F-K linear			
			K/LM			K/LM
γ	100*	0.0445	7.2	9*	0.3069	9.4
	4*	0.0840	5 ?	0.2*	0.3455	
	15*	0.1361	6.6	3*	0.3892	
	1*	0.1805		15*	0.3977	10
	6*	0.2086	6.9	0.3*	0.5259	
	17*	0.2173	10.6	9*	0.6064	7.8
	51*	0.2613	8.0	0.4*	0.8334	
	6*	0.2998	10.8			sd ce

*Relative intensity ce_K

$(ce_K\ 0.044\gamma)\gamma$ delay $< 0.3^{\mu s}$
No $(ce_K\ 0.084\gamma)(E_\gamma > 0.3)$ No $(0.598\beta)\gamma$
$(ce_K\ 0.044\gamma)/e_{AK} = 0.03$ $\beta^+/e_{AK} = 0.25$ sl
$\epsilon_K/\beta^+ = 10.8 \pm 2.0$ (recalculated using K fluorescence yield = 0.63)

S.Thulin, J.Moreau, H.Atterling, Arkiv Fysik 8, 229 (1954).

$Br^{(79)}$(d,2n) chem; ms

β^+	9+	0.330	sl, sl $\beta\gamma$
	91+	(0.598)	sl

$(0.330\beta)(E_\gamma > 0.08)$
$(ce_K\ 0.044\gamma)(E_\gamma \leq 0.22)$
$(ce_K\ 0.084\gamma)(E_\gamma > 0.04)$
$(ce_K\ 0.136\gamma)(E_\gamma \leq 0.27)$
$(ce_K\ 0.261\gamma)(E_\gamma \leq 0.30)$
No $(ce_K\ 0.606\gamma)(E_\gamma > 0.04)$
Decay scheme is proposed

S.Thulin, Arkiv Fysik 9, 137 (1955).

Kr^{79}
36 43
34.5^h

$e_{AL}/e_{AK} = 1.71$ *7* pc
$= 1.80$ *16* cc
Hence $\epsilon_L/\epsilon_K = 0.26$ *3*, 0.16 *3* (theory 0.10) if fluorescence yield = 0.57, 0.60

P.Radvanyi, Ann. Phys. 10, 584 (1955); J. phys. radium 16, 509 (1955).

Kr^{85}
36 49
10.3^y
g.s.

J	9/2	U(n,f)	S
μ	−1.001	from $\mu_{85}/\mu_{83} = 1.035$ *2*	
q	+0.25	from $q_{85}/q_{83} = 1.66$ *10*	

E.Rasmussen, V.Middelboe, Z. Phys. 144, 160 (1955).

U(n,f) chem; ms

β^-	0.672 *7*	$\Delta J = 2$, yes shape	sl
γ	0.517 *5*		scin

S.Thulin, Arkiv Fysik 9, 137 (1955).

Kr^{85}
36 49
4.4^h

U(n,f) chem; ms

β^-	0.824 *8*		sl
γ	(0.305)	K/LM = 6.2	sd ce

S.Thulin, Arkiv Fysik 9, 137 (1955).

Kr^{87}
36 51
78^m

U(n,f) chem; ms

β^-	25%	1.3			sl $\beta\gamma$
	≤10%	~3.3			
	≥65%	(3.8)			
γ	100+	0.403 *4*	≤6+	2.05 *5*	scin
	19+	0.847 *9*	42+	2.57 *4*	
		1.75 ?			

$(1.3\beta)(2.57\gamma)$ $(1.3\beta, 3.8\beta)(0.403\gamma)$ sl,scin
$(\sim 3.3\beta)(0.847\gamma)$
$(0.403\gamma)(2.57\gamma)$ No $(0.403\gamma)(0.847\gamma)$ scin

S.Thulin, Arkiv Fysik 9, 137 (1955).

Kr^{88}
36 52
2.77^h

U(n,f) chem; ms

γ	20+	0.166			sl ce,scin
	100+	0.191	40+	1.55	
	14+	0.36		1.85 ?	
	65+	0.845	≤50+	2.19	
	<10+	1.19 ?	100+	2.40	

$(ce_K\ 0.191\gamma)/(ce_K\ 0.028\gamma) \sim 0.05$
$(0.191\gamma)(\sim 0.5\beta, \sim 2.5\beta)$ $(ce_K\ 0.028\gamma)(\sim 0.5\beta)$
$(0.191\gamma)(2.19\gamma)$ $(ce\ 0.028\gamma)(0.166\gamma, 2.19\gamma)$
No $(ce\ 0.028\gamma)(0.191\gamma, 2.40\gamma)$
No $(0.191\gamma)(0.845\gamma, 2.40\gamma)$

S.Thulin, Arkiv Fysik 9, 137 (1955).

Rb^{81}
37 44
4.7^h

J	3/2	M
μ	+2.00 *6*	

J.P.Hobson, J.C.Hubbs, W.A.Nierenberg, H.B.Silsbee, Phys. Rev. 96, 1450 (1954); Phys. Rev. 99, 612A (1955).

Rb^{85}
37 48
stable

μ +1.348217 I
$\nu(Rb^{85})/\nu(H^2) = 0.628985$ *5*

H.E.Walchli, ORNL-1775 (1954).

Q +0.29 *2* M

H.Kruger, U.Meyer-Berkhout, Naturwiss. 42, 94 (1955); Z. Phys. 141, 185 (1955).

Q +0.31 M

B.Senitzky, I.I.Rabi, M.L.Perl, Phys. Rev. 98, 1537A (1955).

Rb^{86}
37 49
18.7^d

J 2 M
μ −1.69 *1*

E.H.Bellamy, K.F.Smith, Phil. Mag. 44, 33 (1953); Nature 168, 556 (1951).

τ 18.64^d *4* U(n, f) ion chem
Followed 8 samples for 7 to 9 half-lives

J.B.Niday, Phys. Rev. 98, 42 (1955).

τ 18.66^d *3* $Rb^{(85)}$(pile n,γ) chem
γ 8.5%* (1.08) 4π β, ic
Observed for ~4 half-lives
*γ rate from Ra calibrated ic, total β rate from 4π counter. See also K^{42}.

E.W.Emery, J.E.S.Bradley, N.Veall, Nature 175, 34 (1955); E.W.Emery, N.Veall, Proc. Phys. Soc. 68A, 346 (1955).

$Rb^{(85)}$(pile n,γ) chem
β^- 15% ~0.73 F-K linear sd $\beta\gamma$
85% 1.770 *10* ΔJ = 2, yes shape sd
γ 1.08 scin

J.Laberrique-Frolow, M.Lederer, J. phys. radium 16, 346 (1955).

β^- 0.715 *10* sl $\beta\gamma$
1.798 ΔJ = 2, yes shape sl

R.S.Caird, A.C.G.Mitchell, Phys. Rev. 94, 412 (1954).

β^- 15% 0.694 Sπ
5% (0.832)
80% 1.767 ΔJ = 2, yes shape
γ W 0.935 Sπ pe
1.083

L.E.Killion, Washington University, Dissertation Abstr. 15, 858 (1955).

Rb^{86}
37 49
18.7^d

Levels Rb^{85}(d, p) $E_d = 15.1$
g.s. ? Q = 6.2 *3* scin
1.5 ?

N.S.Wall, Phys. Rev. 96, 664 (1954).

Rb^{87}
37 50
$6.2x10^{10y}$

μ +2.741451
$\nu(Rb^{87})/\nu(Na^{23}) = 1.237041$ *8*

H.E.Walchli, ORNL-1775 (1954).

Q +0.14 *1* M

H.Kruger, U.Meyer-Berkhout, Naturwiss. 42, 94 (1955); Z. Phys. 141, 185 (1955).

$q(Rb^{85})/q(Rb^{87}) = 2.0669$ *5*
Implies Q = +0.15 See Rb^{85}, Senitzky et al.

J.W.Trischka, R.Braunstein, Phys. Rev. 96, 968 (1954).

τ 4.3×10^{10y} GM
Corrections for backscattering and absorption

I.Geese-Bähnisch, E.Huster, Naturwiss. 41, 495 (1954).

Rb^{88}
37 51
17.8^m

γ	60+	0.908		U(n, f) chem;	scin
	100+	1.85	<10+	2.76	
	4+	2.18 *3*	0.2+	4.2 *1*	

S.Thulin, Arkiv Fysik 9, 137 (1955).

Sr^{87}
38 49
2.8^h

γ (0.388) $\alpha = 0.28$ ic
Authors conclude γ is E5 d 80^hY

I.A.Antonova, I.V.Estulin, Izvest. Akad. Nauk Ser. Fiz. SSSR 18, 79 (1954); J. phys. radium 16, 534 (1955).

Sr^{88}
38 50
stable

Resonance Sr^{87}(n) chopper

E_o (ev)	Γ_n (10^{-3}ev)	Γ_γ (10^{-3}ev)
3.56	0.60	205

A.Stolovy, J.A.Harvey, Phys. Rev. 99, 611A (1955); priv. comm.

Resonance $Sr^{(87)}$(n,γ) $E_n = 0.025$ to 500 ev
3.58 ev $\sigma_o\Gamma^2 = 5.6$ to 8.4
mod cyc

E.Meservey, Phys. Rev. 96, 1006 (1954); 86, 605A (1952).

Sr^{89}
38 51
50^{d}

τ 50.5^{d} *2* Sr^{88}(slow n,γ) chem

G.Herrmann, Z. Elektrochem. 58, 626 (1954).
G.Herrmann, F.Strassmann, Z.Naturf. 10a,146 (1955).

Levels Sr^{88}(d,p) $E_d = 15.1$
g.s. $Q = 4.29$ *15* scin
1.09

N.S.Wall, Phys. Rev. 96, 664 (1954).

$\mathrm{Sr}^{89?}$
38 51

τ $\sim 10^{d}$ Sr^{88}(slow n,γ) chem
γ
Analysis of decay curve suggests 10^{d} p of 50^{d}Sr

G.Herrmann, Z.Elektrochem. 58, 626 (1954).
G.Herrmann, F.Strassmann, Z.Naturf. 10a,146 (1955).

Sr^{90}
38 52
28^{y}

τ 27.7^{y} *4* U(n,f); 4π pc,ms

D.M.Wiles, R.H.Tomlinson, Can J. Phys. 33, 133 (1955).

τ $\sim 30^{y}$ Specific activity; ms

G.W.Reed, Phys. Rev. 98, 1327 (1955).

τ 28.4^{y}

K.F.Flynn, L.E.Glendenin, E.P.Steinberg, quoted by G.W.Reed, Phys. Rev. 98, 1327 (1955).

Sr^{91}
38 53
9.7^{h}

τ 9.7^{h} *1* U(pile n, f) chem

β^-	50%	0.8	a
	25%	1.4	
	25%	2.7	

p 50^{m}Y chem; p 57^{d}Y chem

G.Herrmann, Z.Elektrochem. 58, 626 (1954).
G.Herrmann, F.Strassmann, Z.Naturf. 10a, 146 (1955).

Y^{88}
39 49
105^{d}
g.s.

$\mathrm{Sr}^{(88)}$(20-Mev d,2n) chem
γ (0.908) scin
1.83
No 2.74γ ($<0.5\%$ of 1.83γ)

D.E.Alburger, A.W.Sunyar, Phys. Rev. 99, 695 (1955).

$\mathrm{Sr}^{(88)}$(18-Mev d,2n) chem
$(0.91\gamma)(1.87\gamma)(\theta)$ J = 3, 2, 0 or 3, 1, 0
$(0.91\gamma)(1.87\gamma)(l_{\bullet})$ consistent with
$J = 3^-, 2^+, 0^+$ or $J = 3^-, 1^+, 0^+$ scin

G.R.Bishop, J.P.Perez y Jorba, Phys. Rev. 98, 89 (1955).

Y^{88}
39 49
0.4^{ms}

τ 3.7×10^{-4s} *3* 85^{d}Zr source
No β^+ (no $\gamma^{\pm}$) scin
γ 0.395 *5* K/LM = 8.4 scin
$\alpha \sim 0.02$ E3
τ from xγ delay

E.K.Hyde, M.G.Florence, A.E.Larsh, Phys. Rev. 97, 1255 (1955).

Y^{90}
39 51
64.2^{h}

τ 64.24^{h} *30* d 28^{y}Sr chem; GM

M.L.Volchok, J.L.Kulp, Phys. Rev. 97, 102 (1955).

τ 64.2^{h} *2* d 28^{y}Sr chem; GM

P.Schmeling, Z. Naturf. 10a, 79 (1955).

τ 64.8^{h} d 28^{y}Sr chem; GM

E.V.Marathe, J. Sci. Ind. Research, India, 14B, 354 (1955).

β^- 100% 2.26 $s\pi$
No other β with $0.5 < E_{\beta} < 2.26$
No photons with $E_{\gamma} \sim 1.75$ ($<5\times10^{-4}\%$) scin
ce corresponding to $E_{\gamma} = 1.75$ (0.005%) and
nuclear pairs ($\sim 0.02\%$) suggest $0^+ \rightarrow 0^+$ sl

O.E.Johnson, R.G.Johnson, L.M.Langer, Phys. Rev. 98, 1517 (1955).

No nuclear γ ($<10^{-4}\%$) scin

B.Saraf, J.Varma, C.E.Mandeville, Phys. Rev. 98, 1206A (1955); priv. comm.

Levels Y^{89}(d,p) $E_d = 15.1$ scin
g.s. $l_n = 2$ $Q = 4.41$ *5*
1.17* $l_n = 0$ d,p(θ)
*Possibly two unresolved levels

N.S.Wall, Phys. Rev. 96, 664, 670 (1954).

Y^{91}
39 52
57^{d}

τ 57.5^{d} *5* U(n, f) chem
β^- 0.36 *2* a $\beta\gamma$
(1.55) 4π pc
γ 0.22% 1.190 *5* scin, ic
No other γ's with $0.1 < E_{\gamma} < 2.0$ ($<0.01\%$)

B.Kahn, W.S.Lyon, Phys. Rev. 98, 58 (1955).

Y^{92}
39 53
3.5^h

$Zr^{(94)}$ (7.8-Mev d,α) chem

τ		3.4^h	1		
β^-		3.6	2		sπ
γ	10+	0.21	1		scin
	11+	0.48	2	(double)	
	19+	0.94	3	(double ?)	
	~10+	1.45	10	?	
	~1+	1.9	1	?	
	~0.2+	2.4	1	?	

($E_\beta > 1.3$) (0.48γ, 0.94γ) ($E_\beta < 1.3$) (1.45γ)
(0.21γ)(0.48γ, 0.94γ, 1.45γ)
(0.48γ)(0.48γ, 0.94γ, 1.45γ)
(0.94γ)(1.45γ)

W.A.Cassatt, Jr., W.W.Meinke, Phys. Rev. 99, 760 (1955).

Zr
40

Zr(p,p'γ) $E_p \lesssim 2.75$ scin
No γ with $E_\gamma < 0.6$

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

Levels Zr(n,n') $E_n = 4.4$ ppl
~0.009+ 2.2
~0.008+ 2.8 ?
No 0.93 level
+ dσ/dω (90°)

J.B.Weddell, B.Jennings, R.L.Hellens, Phys. Rev. 99, 621A (1955).

γ Zr(n,?γ) $E_n = 3.2$ scin

0.038†	0.69	0.14†	1.5
0.40†	0.89	0.44†	2.2
0.12†	1.14		

†σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

γ Zr(n,?γ) $E_n = 4.5$ scin
0.92
2.20
3.27

G.L.Griffith, Phys. Rev. 98, 579 (1955).

Zr^{90}
40 50
0.83^s

τ 0.83^s 3 Zr^{90}(fast n,n')
γ 2.30 2 E5 scin
Graph of σ from threshold (2.3) to 4.4 shows higher levels feed this metastable state
Comparison with Hauser-Feshbach theory gives best fit for $l = 5$*
Not d 15^hNb*

E.C.Campbell, R.W.Peelle, F.C.Maienschein, P.H.Stelson, Phys. Rev. 98, 1172A (1955);
*verbal report.

Zr^{91}
40 51
stable

Resonances Zr^{90}(n) E_n = 5 to 140 kev Li(p,n)

E_o(kev)	Γ(kev)
18	0.12
42	0.40

P.F.Nichols, R.G.Smith, H.W.Newson, Phys. Rev. 99, 621A (1955)

Zr^{92}
40 52
stable

Resonance Zr^{91}(n) chopper

E_o(ev)
296

A.Stolovy, J.A.Harvey, Phys. Rev. 99, 611A (1955); priv. comm.

Zr^{93}
40 53
9.5×10^{5y}

Resonances Zr^{92}(n) E_n = 5 to 140 kev Li(p,n)

E_o(kev)	Γ(kev)
7	0.05
48	0.35

P.F.Nichols, R.G.Smith, H.W.Newson, Phys. Rev. 99, 621A (1955)

Zr^{95}
40 55
65^d

Resonances Zr^{94}(n) E_n = 5 to 140 kev Li(p,n)

E_o(kev)	Γ(kev)
20	0.11
44	0.20
68	0.50

P.F.Nichols, R.G.Smith, H.W.Newson, Phys. Rev. 99, 621A (1955).

γ 0.722 $\alpha_K \sim 1.6 \times 10^{-3}$ sl ce,pe
E2,M1

R.C.Rohr, R.D.Birkhoff, Phys. Rev. 98, 1266 (1955).

Levels Zr^{94}(d,p) $E_d = 15.1$
g.s. Q = 4.19 5 scin
0.9 2

N.S.Wall, Phys. Rev. 96, 664 (1954).

Zr^{96}
40 56
stable

τ_β $\geq 2 \times 10^{16y}$ Natural Zr pc
From absence of negatrons

H.Selig, Thesis, Carnegie Inst. Tech. (1954).

Zr^{97}
40 57
17.0^h

γ 2% 1.6 Zr^{96}(pile n,γ); scin

B.Saraf, J.Varma, C.E.Mandeville, Phys. Rev. 98, 1206A (1955); priv. comm.

Nb
41

Abundances ms
Nb^{93} 100%
All others $< 2 \times 10^{-4}$%

F.A.White, T.L.Collins, F.M.Rourke, Phys. Rev. 98, 1174A (1955).

Nb^{89} 41 48 1.9^h g.s.

τ 1.9^h $Zr^{(90)}$(40-Mev p,2n)
Y^{89}(60-Mev α,4n) chem
β^+ 2.85 *10* scin
No γ scin
p 79^{h}Zr chem

H.B.Mathur, E.K.Hyde, C.A.Levine, P.K.Kofstad Phys. Rev. 97, 117 (1955).

Nb^{89} 41 48 ~2^h

τ ~2^h $Zr^{(90)}$(40-Mev p,2n)
p 4.8^{m}Zr chem Y^{89}(60-Mev α,4n) chem

H.B.Mathur, E.K.Hyde, C.A.Levine, P.K.Kofstad, Phys. Rev. 97, 117 (1955).

Nb^{90} 41 49 15^h g.s.

τ 14.60^h *6* Zr(26-Mev d) chem

			K/L	α_K	
β^+	4.5†	0.55			scin,sd
	8.5†	0.865			
	87†	1.500 *5*			
γ	vw†	0.133	3.6±0.4	large	E3,M2
	135†	0.142	5.8±0.6	0.32	E2
	3.5†	0.372	6.5±1.0	0.009	E2
	130†	1.130		0.00025	E2
	40†	1.27		<0.0005	
	20†?	1.767			
	120†	2.201		0.00006	E1

(1.5β)(ce$_K$ 0.142γ) $\gamma^{\pm}$(0.142γ, 1.13γ)
No(1.5β)(ce$_K$ 0.133γ) †Relative to 100 β^+

Ong Ping Hok, P.Kramer, G.Meijer, Physica 20, 1200(1954).

Zr(20-Mev p) chem
β^+ 1.7 *1* scin
γ 10† 0.140 scin
28† 1.14
17† 2.20
(K x ray)/(0.14γ) = 0.8
(0.14γ, 1.14γ) $\gamma^{\pm}$ (0.14γ)(1.14γ)
No (2.2γ)(K x ray, 0.14γ, $\gamma^{\pm}$, 1.14γ)
Absence of 2.2 γ after fast chem and absence of (2.2γ)(K x ray, $\gamma^{\pm}$) imply 1^m > delay > 5$^{\mu s}$

H.B.Mathur, E.K.Hyde, Phys. Rev. 98, 79, 261A (1955).

Nb^{90} 41 49 24^s

τ 24^S *3* 5.7^{h}Mo source chem
γ 0.120 α_K ~0.5 x/γ scin
K/LM = 3.6 ±0.2 sd ce
d 5.7^{h}Mo

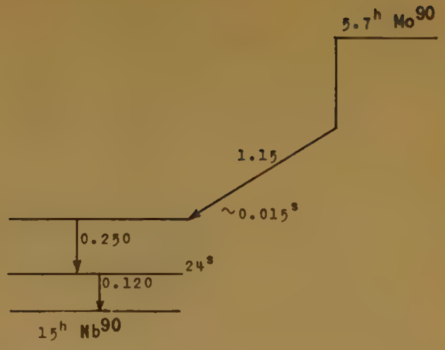
H.B.Mathur, E.K.Hyde, Phys. Rev. 98, 79, 261A (1955).

Nb^{90} 41 49 0.015^s

τ 0.015^S *5* 5.7^{h}Mo source
γ 0.250 K/LM = 5.2±0.2 sd,scin

(Continued)

Nb^{90} 41 49



H.B.Mathur, E.K.Hyde, Phys. Rev. 98, 79, 261A (1955).

Nb^{91} 41 50 64^d

$Zr^{(90)}$(16-Mev d,n) chem
ϵ Zr K x ray crit a
No β^+ (<0.1%) scin
γ(Nb^{91}) 10† 0.104 *1* K/LM = 2.1 sl ce,scin
γ(Zr^{91}) 51† 1.21 scin
(1.21γ)(Zr K x ray)

R.W.Hayward, D.D.Hoppes, H.Ernst, Phys. Rev. 98, 231A (1955); verbal report.

γ 0.1043 K/L = 2.0 ±0.1 sd ce

Ong Ping Hok, P.Kramer, G.Meijer, Physica 20, 1200 (1954).

Nb^{92} 41 51 10^d

$Zr^{(91)}$(14-Mev d,n) chem
ϵ Zr K x ray crit a
No β^+ (<0.01%) scin
γ 1.3† 0.900 scin
97.8† 0.934
2.2† 1.83
(0.93γ, 1.83γ)(Zr K x ray)
(0.90γ)(0.93γ)(θ) $\eta(\pi)$ = 0.21

R.W.Hayward, D.D.Hoppes, H.Ernst, Phys. Rev. 98, 231A (1955); verbal report.

Nb^{93} 41 52 stable

q −0.4 *3* S

D.R.Speck, F.A.Jenkins, Phys. Rev. 98, 282A (1955).

q −0.2 *1* S

K.Murakawa, Phys. Rev. 98, 1285 (1955).

Level Nb^{93}(p,p'γ) E_p = 2.75 to 4.0
0.71 E2 from $\sigma(E_p)$ γ scin

D.M.Van Patter, M.A.Rothman, C.E.Mandeville, C.P.Swann, J.Franklin Inst. 259, 261 (1955).

Nb^{93}
41 52
stable

$Nb^{93}(p,p'\gamma)$ $E_p \leq 2.75$
No γ with $E_\gamma < 0.6$ scin

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

γ $Nb^{93}(n,?\gamma)$ $E_n = 3.2$ scin
0.27 0.69
0.53 0.91

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Nb^{94}
41 53
2×10^{4y}

τ 1.8×10^{4y} *4* $Nb^{93}(\text{th } n,\gamma)$ chem
β^- 0.5-0.6 a
γ 0.726 scin
0.903
1.65

M.A.Rollier, E.Saeland, A.Morpurgo, A.Cagliaris, Acta Chem. Scandinavica 9, 57 (1955).

Nb^{95}
41 54
90^h

γ 0.236 $K/L = 3.7 \pm 0.1$ sd ce

Ong Ping Hok, P.Kramer, G.Meijer, Physica 20, 1200(1954).

Nb^{97}
41 56
74^m
g.s.

γ 0.67 d 60^sNb; scin

B.Saraf, J.Varma, C.E.Mandeville, Phys. Rev. 98, 1206A (1955); priv. comm.

Nb^{97}
41 56
60^s

γ 0.75 d 17^hZr; scin

B.Saraf, J.Varma, C.E.Mandeville, Phys. Rev. 98, 1206A (1955); priv. comm.

Mo
42

γ $Mo(n,?\gamma)$ $E_n = 3.2$ scin
0.66† 0.73
0.33† 1.4
0.06† 2.5
†σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Resonances Mo(n) E_n = 10 to 750 ev

E_o (ev)	Γ_n (10^{-3} ev)*
406 *17*	30 *18*
440 *20*	110 *40*
510 *20*	110 *60*

Assigned to Mo^{93}, Mo^{95}, Mo^{99}, or Mo^{101}
*Based on $\overline{\Gamma}_\gamma = 0.26 \pm 0.08$ ev and an average isotopic abundance of 15% chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Mo^{90}
42 48
5.7^h

Nb^{93}(80-Mev p,4n) chem
β^+ 1.15 *10* scin
γ (0.120) See 24^sNb
(0.250) See 0.015^sNb
1.14 γ assigned to 15^hNb scin
No $(0.120\,\gamma)(0.250\,\gamma,\gamma^{\pm})$ scin
$(0.250\,\gamma)\,\gamma^{\pm}$ delay $0.01\text{-}0.02^s$
p 15^hNb chem

H.B.Mathur, E.K.Hyde, Phys. Rev. 98, 79 (1955).

Mo^{91}
42 49
15.5^m
g.s.

τ 15.7^m *3* $Mo^{(92)}(\leq 14\text{-Mev } \gamma,n)$
β^+ scin
No γ

P.Axel, J.D.Fox, R.M.Parker, Phys. Rev. 97, 975 (1955).

Mo^{91}
42 49
66^s

τ 66^s *3* $Mo^{(92)}(< 14\text{-Mev } \gamma,n)$
β^+ ~30% scin
γ ~70% 0.650 *15* M4
W 1.22 *3*
W 1.55 *3*
Threshold (66^s) - threshold(15.5^m) = -30 ± 60 kev

P.Axel, J.D.Fox, R.M.Parker, Phys. Rev. 97, 975 (1955).

Mo^{92}
42 50
stable

$\tau_{\beta\beta}$ $\geq 4\times10^{18y}$ Natural Mo cc
From absence of pairs of positrons

R.G.Winter, Phys. Rev. 99, 88 (1955).

Mo^{93}
42 51
$> 2^y$

Levels $Mo^{92}(d,p)$ $E_d = 15.1$
g.s. Q = 5.63 *5* scin
0.91 *10*
1.41 *10*
2.23 *10*
2.73 *10*

N.S.Wall, Phys. Rev. 96, 664 (1954).

Mo^{94}
42 52
stable

Level $Mo^{94}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.5$; γ scin
0.871 *13* $\tau = 0.9^{\mu\mu s}$ ($\alpha = 0.0011$)

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 99, 617A (1955); verbal report.

Level $Nb^{93}(p,\gamma)$ $E_p = 2.75$ to 4.0
0.87 γ scin

D.M.Van Patter, M.A.Rothman, C.E.Mandeville, C.P.Swann, J.Franklin Inst. 259, 261 (1955).

Mo^{95}
42 53
stable

Level $Mo^{95}(\alpha,\alpha'\gamma)$ $E_{\alpha} = 6.0$; γ scin
0.204 *4* $\epsilon B(E2) = 0.035$

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 99, 617A (1955); verbal report.

Level $Mo^{(95)}(p,p'\gamma)$ $E_p = 2.9$; γ scin
0.212 *3* $\epsilon B(E2) = 0.041$

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112 (1955).

Level $Mo^{(95)}(p,p'\gamma)$ $E_p = 2.5$; γ scin
0.199 $\epsilon B(E2) = 0.057$

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955); 99, 617A (1955).

Mo^{96}
42 54
stable

Level $Mo^{96}(\alpha,\alpha'\gamma)$ $E_{\alpha} = 6.5$; scin
γ 0.778 *11* $\tau = 1.7^{\mu\mu s}$ $(\alpha = 0.0013)$

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 99, 617A (1955); verbal report.

Resonances $Mo^{95}(n)$ $E_n = 10$ to 750 ev

E_o (ev)	$\Gamma_n (10^{-3}$ ev)*
45.0 *6*[1]	174 *10*
162 *4*	13.6 *19*
570 *30*	120 *60*
700 *40*	740 *130*

*Based on $\overline{\Gamma}_{\gamma} = 0.26 \pm 0.08$ ev chopper
Γ_{γ} (measured) = [1]0.206 ± 0.060 ev

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Mo^{97}
42 55
stable

Resonance $Mo^{96}(n)$ $E_n = 10$ to 750 ev

E_o (ev)	$\Gamma_n (10^{-3}$ ev)*
133 *2*	200 *15*

*Based on $\overline{\Gamma}_{\gamma} = 0.26 \pm 0.08$ ev chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Mo^{98}
42 56
stable

Level $Mo^{98}(\alpha,\alpha'\gamma)$ $E_{\alpha} = 6.5$; γ scin
0.786 *11* $\tau = 1.8^{\mu\mu s}$ $(\alpha = 0.0013)$

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 99, 617A (1955); verbal report.

Level $Mo^{(98)}(p,p'\gamma)$ $E_p = 3.0$; γ scin
0.77 *1* $\tau = 2.5^{\mu\mu s}$* $(\alpha = 0.001)$
*Yield not corrected for Mo^{96} 0.778 γ

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112 (1955).

Mo^{98}
42 56
stable

Levels $Mo^{97}(d,p)$ $E_d = 15.1$
g.s. Q = 6.06 *10* scin
2.5 *3*

H.S.Wall, Phys. Rev. 96, 664 (1954).

Resonances $Mo^{97}(n)$ $E_n = 10$ to 750 ev

E_o (ev)	$\Gamma_n (10^{-3}$ ev)*
71.5 *12*[1]	16.6 *18*
292 *10*	75 *15*
406 *17*	80 *40*
580 *30*	670 *130*

*Based on $\overline{\Gamma}_{\gamma} = 0.26 \pm 0.08$ ev chopper
Γ_{γ} (measured) = [1]0.330 ± 0.080 ev

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Mo^{99}
42 57
68^h

β^- 0.41 sl $\beta\gamma$, sl
0.80
1.18

γ 35* (0.040) $\alpha \sim 30$ E2 $\gamma\gamma/\gamma$
65* (0.18) $\alpha \sim 0.6$ M1
0.39 *2* $\beta\gamma$

$(0.41\beta)(0.74 + 0.78\gamma)$ $(E_{\beta} \simeq 0.56)(0.39\gamma)$
$(0.80\beta)(0.39\gamma)/\beta = 0.03$
*Relative numbers of photons plus ce

C.Lévi, L.Papineau, Compt. rend. 239, 1782 (1954).

$(0.740\gamma)(0.181\gamma)(\theta)$ J = 1/2, 5/2, 9/2 scin
$Mo^{(98)}$(pile n,γ)

U.Cappeller, R.Klingelhöfer, Z. Phys. 139, 402 (1954).

$(0.74\gamma)(0.14\gamma, 0.18\gamma)$ delay=$3.5 \pm 0.3 \times 10^{-9s}$
scin

P.Lehmann, J.Miller, Compt. rend. 240, 1525 (1955).

Resonance $Mo^{98}(n)$ $E_n = 10$ to 750 ev

E_o (ev)	$\Gamma_n (10^{-3}$ ev)*
480 *20*	740 *110*

*Based on $\overline{\Gamma}_{\gamma} = 0.26 \pm 0.08$ ev chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Mo^{100}
42 58
stable

τ_{β} $\geq 2 \times 10^{16y}$ Natural Mo chem; pc
From absence of negatrons

H.Selig, Thesis, Carnegie Inst. Tech. (1954).

$\tau_{\beta\beta}$ $\geq 3 \times 10^{17y}$ Natural Mo cc
From absence of pairs of negatrons

R.G.Winter, Phys. Rev. 99, 88 (1955).

Mo^{100} $_{42}$ $_{58}$ stable

Level — $Mo^{100}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; γ scin
0.528 *8* — $\tau = 8.4^{\mu\mu s}$ — $(\alpha = 0.0043)$

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 99, 617A (1955); verbal report.

Level — $Mo^{(100)}(p,p'\gamma)$ $E_p = 3.0$; γ scin
0.540 *7* — $\tau = 9.5^{\mu\mu s}$ — $(\alpha = 0.004)$

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112 (1955).

Level — $Mo^{(100)}(p,p'\gamma)$ $E_p = 2.5$; γ scin
0.525

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

Mo^{101} $_{42}$ $_{59}$ 14.6^m

Resonance — $Mo^{100}(n)$ — E_n = 10 to 750 ev

E_o (ev)	Γ_n (10^{-3} ev)*
367 *15*	1000 *120*

*Based on $\overline{\Gamma}_\gamma = 0.26 \pm 0.08$ ev — chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Tc^{97} $_{43}$ $_{54}$ 91^d

γ — 1* — 0.0902 — K/L ~ 1 — α large — scin, $s\pi$ ce
~ 1* — 0.0992
d 2.44^dRu
*Relative intensity of ce_K

J.M.Cork, M.K.Brice, L.C.Schmid, R.G.Helmer, Phys. Rev. 100, 188, 955A (1955).

Tc^{98} $_{43}$ $_{55}$

Indications for natural Tc^{98} from:

1. 6^h period produced by pile irradiation of Re ores
2. Abnormal abundance of Ru^{98} in Mo ores

W.Herr, Z. Naturf. 9a, 907 (1954).

Indications for natural Tc^{98} from observation of 6^hTc from thermal neutron activation of minerals processed for Mo removal

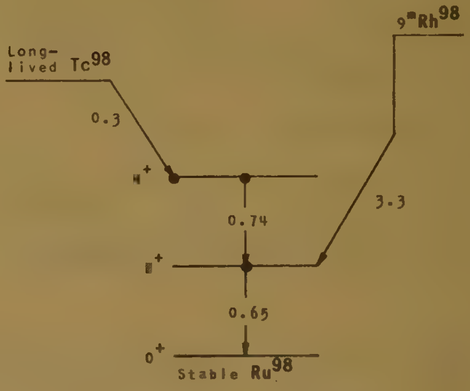
E.A.Alperovitch, J.M.Miller, Nature 176, 299 (1955); Phys. Rev. 98, 262A (1955).

$Mo^{(98)}$(22-Mev p,n) — chem
Tc^{98} found by ms in Tc fraction 270 days after irradiation

G.E.Boyd, J.R.Sites, O.V.Larson, C.R.Baldock, Phys. Rev. 99, 1030 (1955).

Tc^{98} $_{43}$ $_{55}$

τ — ~ 10^{4y*} — $Ru^{(98)}$(pile n,p) — chem
β^- — 0.30 — scin
γ — 1+ — 0.65 — scin
1+ — 0.74
$(0.30\beta)(0.65\gamma, 0.74\gamma)$ — $(0.65\gamma)(0.74\gamma)$
No (K x ray)$(0.65\gamma, 0.74\gamma)$
*Assuming $\sigma[Ru^{98}(n,p)] \sim 3 \times \sigma[Ru^{97}(n,p)]$



S.Katcoff, Phys. Rev. 99, 1618 (1955).

$Ru^{<94}$ $_{44}$

τ — 52^s *10* — Mo(42-Mev α) — chem
β — scin
γ (or $\gamma^\pm$)
Mass assignment from yield as $f(E_\alpha)$

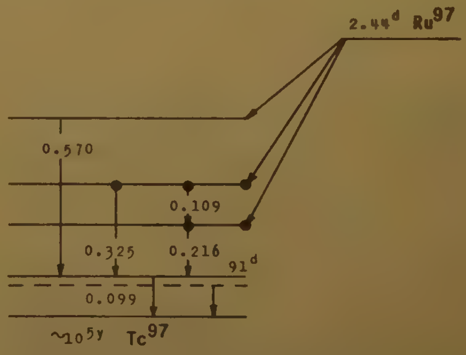
A.H.W.Aten, Jr., T.de Vries-Hamerling, Physica 21, 544 (1955).

Ru^{97} $_{44}$ $_{53}$ 2.44^d

τ — 2.44^d — Ru^{96}(pile n,γ)

			K/L		
γ	3*	0.1091	3.0	α large	$s\pi$ ce,
	100*	0.2161	7.3		scin
	8*	0.3251	6.7		
		0.570			

No β^+ — scin, sd
$(0.109\gamma)(0.216\gamma)$ — No $(0.216\gamma)(0.325\gamma)$
x$(0.109\gamma, 0.216\gamma, 0.325\gamma)$
*Relative intensity of ce_K



J.M.Cork, M.K.Brice, L.C.Schmid, R.G.Helmer, Phys. Rev. 100, 188, 955A (1955).

Ru^{97}
44 53
2.44^{d}

τ 2.8^{d} d 31^{m}Rh chem
γ 0.220 scin

A.H.W.Aten, Jr., T.de Vries-Hamerling, Physica 21, 597 (1955).

Ru^{99}
44 55
stable

Level $\mathrm{Ru}^{99}(\alpha,\alpha'\gamma)$ $E_{\alpha} = 7$; γ scin
0.0895 $\epsilon B(E2) = 0.020$

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 100, 961A (1955); priv. comm.

Ru^{100}
44 56
stable

Level $\mathrm{Ru}^{(100)}(\alpha,\alpha'\gamma)$ $E_{\alpha} = 6.0$; scin
γ 0.540 *8* $\tau = 16^{\mu\mu s}$ $(\alpha = 0.0043)$

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 99, 617A (1955); verbal report.

Ru^{101}
44 57
stable

Levels $\mathrm{Ru}^{101}(\alpha,\alpha'\gamma)$ $E_{\alpha} = 7$; γ scin

	$\epsilon B(E2)$
0.127	0.021
0.307	0.034
0.522	0.11

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 100, 961A (1955); priv. comm.

Ru^{102}
44 58
stable

Level $\mathrm{Ru}^{(102)}(\alpha,\alpha'\gamma)$ $E_{\alpha} = 6.0$; scin
γ 0.473 *7* $\tau = 16^{\mu\mu s}$ $(\alpha = 0.0062)$

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 99, 617A (1955); verbal report.

Ru^{103}
44 59
40^{d}

$\mathrm{Ru}^{(102)}$(pile n, γ) chem
β^{-} 7%* 0.11 *1* 0.1%* (0.670) scin
(90%) (0.220) 3%* (0.715) $\beta\gamma$
γ 6† 0.055 *3* $\alpha_{K} = 1.2 \pm 0.3$ M1 scin
6† 0.440 *10* 6† 0.555 *10* $\gamma\gamma$
1000† 0.495 *5* 70† 0.610 *5*
$(0.220\ \beta)(0.495\ \gamma)$ $(0.110\ \beta)(0.610\ \gamma)$ scin
No (hard β)$(0.055\ \gamma)$ $(0.055\ \gamma)(0.44\ \gamma, 0.55\ \gamma)$
No 0.300 γ, 0.365 γ (< 1†)
Decay scheme proposed
*Calculated from corresponding γ intensities

B.Saraf, Phys. Rev.97, 715 (1955); J. Franklin Inst. 258, 517A (1954).

Ru(28-Mev d) chem
β^{-} 7% 0.14 *4* a$\beta\gamma$
89% (0.217)
~0.3%* (0.398)
~0.4%* (0.460)
3.0%** (0.702)
γ 4† 0.058 *5* scin
~4† (0.295)
~3† (0.357)
1000† 0.498 K/LM = 8 ± 2 scin, sl ce
78† (0.611) $\alpha_{K} = 6 \pm 2 \times 10^{-4**}$ E1
x 91† Rh K x ray

(Continued)

Ru^{103}
44 59
40^{d}

$(0.14\ \beta)(0.611\ \gamma)$ No $(0.70\ \beta)(0.058\ \gamma)$ scin
*Calculated from corresponding γ intensities
**Based on α_{K} $(0.498\ \gamma) = 0.01$
Decay scheme proposed

B.De Raad, W.C.Middelkoop, B. Van Nooyen, P.M.Endt, Physica 20, 1278 (1954).

β^{-} 28% 0.128 *4* sl
70% 0.202 *2*
~1% 0.374 *20* ?
~1% 0.695 *15*
γ 0.055 scin
0.297 sl pe
0.323 sl pe
0.366 sl pe
0.498 scin
0.610 scin

H.H.Forster, A.Rosen, Nuovo Cim. 1, 972; Phys. Rev. 98, 1172A (1955); verbal report.

Ru^{104}
44 60
stable

Level $\mathrm{Ru}^{(104)}(\alpha,\alpha'\gamma)$ $E_{\alpha} = 6.0$; scin
γ 0.355 *6* $\tau = 60^{\mu\mu s}$ $(\alpha = 0.014)$

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 99, 617A (1955); verbal report.

Ru^{107}
44 63
4^{m}

β^{-} ~4 $\mathrm{Pd}^{(110)}$(fast n, α) chem
High energy γ's U(28-Mev d, f), U(n, f) chem
p 24^{m}Rh

G.B.Baró, P.Rey, W.Seelmann-Eggebert, Z.Naturf. 10a, 81 (1955).

$\mathrm{Ru}^{108?}$
44 64

τ ~4^{m} U(28-Mev d, f) chem
p 18^{s}Rh chem Mass assignment uncertain

G.B.Baró, P.Rey, W.Seelmann-Eggebert, Z.Naturf. 10a, 81 (1955).

Rh^{96}
45 51
~11^{m}

τ ~11^{m} Ru^{96}(10-Mev p,n) chem

D.J.Farmer, Phys. Rev. 99, 659A (1955); verbal report.

Rh^{97}
45 52
31^{m}

τ 35^{m} *10* Ru(d) chem
p 2.8^{d}Ru chem

A.H.W.Aten, Jr., T.de Vries-Hamerling, Physica 21, 597 (1955).

Rh^{98}
45 53
9^{m}

τ 9^{m} d 17^{m}Pd chem
β^{+} 100+ 3.3 *4* a
γ 120+ 0.65 *2* scin
Other γ's with $E_{\gamma} > 0.7$

A.H.W.Aten, Jr., T.de Vries-Hamerling, Physica 21, 597 (1955); 19, 1200 (1953).

$Rh^{99?}$ 45 54
Ru^{99} (10-Mev p,n) chem
τ 15.0^d *2*
γ 0.089 sl ce
0.353
$(0.089\gamma)(0.353\gamma)$ $\gamma^{\pm}(0.089\gamma, 0.353\gamma)$

D.J.Farmer, Phys. Rev. 99, 659A (1955); verbal report.

Rh^{101} 45 56 4.3^d g.s.
τ 4.3^d Ru^{101} (10-Mev p,n) chem
γ 3* 0.158 α large M4 sl ce
K : L : M = 17 : 6 : 1
*Relative intensity ce. See below

D.J.Farmer, Phys. Rev. 99, 659A (1955); verbal report.

Rh^{101} 45 56 4.3^h
τ 4.3^h
γ 1* 0.307 K/LM ~ 7 sl ce,pe
*Relative intensity ce. See above

D.J.Farmer, Phys. Rev. 99, 659A (1955); verbal report.

$Rh^{<102}$ 45
τ 5^y *1* Ru (10-Mev p,n) chem
γ 0.127 K/L ~ 8 sl ce
0.198
$(0.127\gamma)(0.198\gamma)$ No $\gamma^{\pm}(0.127\gamma, 0.198\gamma)$
*Both γ's converted in Rh

D.J.Farmer, Phys. Rev. 99, 659A (1955); *verbal report.

Rh^{102} 45 57 210^d
Ru^{102} (10-Mev p,n) chem
γ 0.474 0.766 sl pe
0.626 1.040
0.695 1.105
No 0.086γ, 0.127γ, 0.198γ, 0.353γ
$(0.474\gamma)(0.626\gamma)$ $\gamma^{\pm}(0.474\gamma, 0.626\gamma)$

D.J.Farmer, Phys. Rev. 99, 659A (1955); verbal report.

ϵ Ru K x ray pc, crit a
γ 54+ 0.125 *3* scin
58+ 0.200 *4* ~15+ 0.72 *2*
80+ 0.475 *5* <10+ 0.79 *2*
26+ 0.635 *5* 56+ 1.08 *1*
Other γ's with $E_\gamma > 1.1$ No 0.086γ, 0.353γ
$(0.475\gamma)/\beta^+ > 20$ $(0.475\gamma)/(K\ x\ ray) = 0.8$

P.Avignon, Compt. rend. 240, 176 (1955).

γ 0.125 scin
0.195
0.475
0.630
0.720
0.780
1.08
$(0.125\gamma)(0.195\gamma)$ x(all γ's)
$(0.475\gamma)/\beta^+ = 10$ $\gamma\gamma^{\pm}(\theta)$ scin

L.Dick, R.Foucher, N.Perrin, H.Vartapetian, Compt. rend. 240, 1335 (1955).

Rh^{102} 45 57 210^d
Ru (28-Mev d) chem
γ 0.123 scin
0.195
0.479
0.633
0.710
0.880 ?
1.07 Double?
1.50
1.72
No 0.086γ, 0.353γ

D.Bès, H.Bosch, Compt. rend. 240, 294 (1955).

Rh^{103} 45 58 stable
μ −0.08791 *7** Metallic Rh; I
$\nu(Rh^{103})/\nu(H^2) = 0.205574$ *7*
*Corrected for Knight shift for metal

P.B.Sogo, C.D.Jeffries, Phys. Rev. 98, 1316, 265A (1955).

Levels $Rh^{103}(p,p'\gamma)$ $E_p = 2.1$ to 3.9
0.30 level J = 3/2⁻ p,$\gamma(\theta)$
γ 0.305 *5* $\epsilon B(E2) = 0.20$ scin
E2/M1 = 0.032 or 1.37
p,$\gamma(\theta)$
0.36 level J = 5/2⁻ p,$\gamma(\theta)$
γ 6+ 0.065 *3*
100+ 0.365 *5* $\epsilon B(E2) = 0.36$ scin

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112, 127 (1955).

Rh^{103} 45 58 57^m
γ 0.0402 *5* $\alpha_K = 40$ d 17^dPd
K/L = 0.09 sl ce

P.Avignon, A.Michalowicz, R.Bouchez, J. phys. radium 16, 404 (1955).

Rh^{104} 45 59 44^s g.s.
β^- 0.11% 0.64 Rh^{103} (pile n,γ); sl $\beta\gamma$
1.85% 1.88 sl $\beta\gamma$
98% 2.44 scin, sl
γ 100+ 0.556 scin
5.8+ 1.24
No other γ with $0.05 < E_\gamma < 0.55$
$(0.556\gamma)(1.24\gamma)$ No 1.80γ (<0.3+)

M.E.Bunker, J.P.Mize, J.W.Starner, Phys. Rev. 99, 659A (1955); verbal report.

Rh^{104} 45 59 4.3^m
β^- 0.026%* (0.30) Rh^{103} (pile n,γ)
0.12%* (0.48)
γ ~100%* 0.051 IT scin
100+ 0.556 1.4+ 0.93
4.7+ 0.745 0.6+ 1.34
5.7+ 0.78 1.9+ 1.53

(Continued)

Rh^{104}
45 59
4.3^{m}

No other γ with $0.05 < E_\gamma < 0.55$
(0.556 γ)(~0.76 γ, 0.93 γ, 1.53 γ)
(~0.76 γ)(~0.76 γ, 0.93 γ, 1.34 γ)
(1.34 γ)(0.745 γ, 0.93 γ)
*Calculated from γ intensities
+γ intensities in equilibrium mixture

M.E.Bunker, J.P.Mize, J.W.Starner, Phys. Rev. 99, 659A (1955); verbal report.

Rh^{105}
45 60
36.5^{h}

$Ru^{(104)}$ (pile n,$\gamma\beta$) chem

β^-	~65%	0.247	*5*	F-K linear	sd $\beta\gamma$
	~35%	0.560	*5*		sd
γ	~25%	0.310	*5*	$\alpha = 0.02$	sd ce

No 0.063 γ (photons < 0.1%) scin, sd ce

J.Laberrique-Frolow, Compt. rend. 240, 287 (1955).

Rh^{106}
45 61
30^{s}

(0.513 γ)(0.624 γ) d 1.0^{y}Ru; Σscin

D.C.Lu, W.H.Kelly, M.L.Wiedenbeck, Phys. Rev. 97, 139 (1955).

No delayed $\beta\gamma$ ($\tau_\gamma < 5\times10^{-10s}$)

V.Z.Wintersteiger, Bull. Inst. Nuclear Sci., Boris Kidrich 4, 79 (1954).

$Rh^{106?}$
45 61

			Pd(30-Mev d)	chem
τ		117^{m}	Pd(fast n)	chem
β^-	~100%	0.7		a
	w	0.95 ?		

No β^+
Complex γ spectrum E_γ/β~4 Mev a, scin
Not d 1.0^{y}Ru; not d short-lived Ru
Not produced by U, Th(30-Mev d, f)

G.B.Baró, W.Seelmann-Eggebert, I.E.Zabala, Z. Naturf. 10a, 80 (1955).

Rh^{107}
45 62
24^{m}

τ		23^{m}	d 4^{m}Ru	chem
β^-	~100%	1.15		a
	w	~2		
γ		0.315		scin
		0.400		
		0.580		
		0.680		

Other weak γ's

G.B.Baró, P.Rey, W.Seelman-Eggebert, Z.Naturf. 10a, 81 (1955).

τ	25^{m}		U,Ta^{181}(340-Mev p)	chem
γ	0.095	*5*		
	0.145	*5*		scin
	0.305	*5*		
	0.390	*10*		
	0.475	*10*		d Ru

W.E.Nervik, G.T.Seaborg, Phys. Rev. 97, 1092 (1955).

$Rh^{107?}$
45 62

		U,Ta^{181}(340-Mev p)	chem
τ	2.3^{h}	Not d ≥ 1^{m}Ru	
β^-	~1		s
γ	0.195	1.06	scin
	0.225	1.20	
	0.510	1.26	
	0.630	1.50	
	0.715		

Mass assignment uncertain, possibly Rh^{106}

W.E.Nervik, G.T.Seaborg, Phys. Rev. 97, 1092 (1955).

$Rh^{108?}$
45 63

τ	18^{s} *1*	d ~4^{m}Ru	chem
β^-	4-5		a

Complex γ spectrum a, scin
Mass assignment uncertain, but not p 13^{h}Pd^{109}

G.B.Baró, P.Rey, W.Seelman-Eggebert, Z.Naturf. 10a, 81 (1955).

Pd^{98}
46 52
17^{m}

		$Ru^{(96)}$ (24-Mev α, 2n)	chem
τ	17^{m} *3*		
γ	0.132	τ~22^{m}($Pd^{98,99?}$)	scin

p 9^{m}Rh chem

A.H.W.Aten, Jr., T.de Vries-Hamerling, Physica 21, 597 (1955); 19, 1200 (1953).

$Pd^{99?}$
46 53

τ	24^{m} *10*	Ru(52-Mev α)	
γ	0.132	τ~22^{m}($Pd^{98,99?}$)	scin

p 4.5^{h}Rh chem

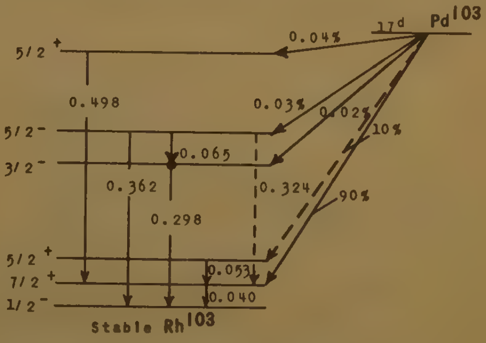
A.H.W.Aten, Jr., T.de Vries-Hamerling, Physica 21, 597 (1955).

Pd^{103}
46 57
17^{d}

Rh^{103} (28-Mev d, 2n) chem

γ	2.1+	0.0402	*5*	See 57^{m}Rh	scin
	0.005+	0.0530		$\alpha_K > 10^4$ K/L~1	sl ce
	0.04+	0.065	*1*		
	0.3+	0.298	*2*		
	~0.1+	0.324	*2*	α_K~10 K/L~10	
	2.1+	0.362	*3*		
	0.45+	0.498	*4*		

+Photons/100 Rh K x rays
No 0.26 γ, no 0.611 γ



P.Avignon, A.Michalowicz, R.Bouchez, J. phys. radium 16, 404; 14, 637 (1955).

Pd^{103} 46 57 17^{d}

Pd^{102}(pile n,γ) chem

γ ~100† 0.040 scin
4† 0.065 *3*
~0.260?
12† 0.300 *5*
~66† 0.365 *5*
10† 0.495 *5*

(0.065 γ)(0.300 γ) No other $\gamma\gamma$ scin
Decay scheme proposed
†Photons per 10^5 disintegrations

B.Saraf, Phys. Rev. 97, 715 (1955); J.Franklin Inst. 258, 517A (1954).

Pd^{104} 46 58 stable

Level $Pd^{104}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; γ scin
0.550 *8* $\tau = 9^{\mu\mu s}$ ($\alpha = 0.004$)

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 98, 1308 (1955); 99, 617A (1955).

Level $Pd^{(104)}(p,p'\gamma)$ $E_p = 3.5$; γ scin
0.575 *10* $\tau = 8.3^{\mu\mu s}$ ($\alpha = 0.004$

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112 (1955).

Pd^{105} 46 59 stable

γ $Pd^{105}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; γ scin
0.266 *5* $\epsilon B(E2) = 0.013$
0.433 *7* $= 0.18$

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 98, 1308 (1955); 99, 617A (1955).

γ $Pd^{105}(p,p'\gamma)$ $E_p = 2.5$; γ scin
0.270 $\epsilon B(E2) = 0.0084$
0.430 $= 0.057$

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955); 99, 617A (1955).

Pd^{106} 46 60 stable

Level $Pd^{106}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; γ scin
0.510 *8* $\tau = 11^{\mu\mu s}$ ($\alpha = 0.006$)

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 98, 1308 (1955); 99, 617A (1955).

Level $Pd^{(106)}(p,p'\gamma)$ $E_p = 2.9$; γ scin
0.520 *7* $\tau = 10^{\mu\mu s}$ ($\alpha = 0.006$)
$J = 2^+$ p,$\gamma(\theta)$

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112, 127 (1955).

Level $Pd^{106}(p,p'\gamma)$ $E_p = 2.8$; γ scin
0.500 $\tau = 50^{\mu\mu s}$ ($\alpha = 0.006$)

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955); 99, 617A (1955).

Pd^{108} 46 62 stable

Level $Pd^{108}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; γ scin
0.424 *6* $\tau = 27^{\mu\mu s}$ ($\alpha = 0.009$)

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 98, 1308 (1955); 99, 617A (1955).

Level $Pd^{(108)}(p,p'\gamma)$ $E_p = 2.5$; γ scin
0.445 *5* $\tau = 15^{\mu\mu s}$ ($\alpha = 0.009$)
$J = 2^+$ p,$\gamma(\theta)$

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112, 127 (1955).

Level $Pd^{108}(p,p'\gamma)$ $E_p = 2.8$; γ scin
0.425 $\tau = 100^{\mu\mu s}$ ($\alpha = 0.009$)

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955); 99, 617A (1955).

Pd^{110} 46 64 stable

Level $Pd^{(110)}(p,p'\gamma)$ $E_p = 2.9$; γ scin
0.380 *5* $\tau = 36^{\mu\mu s}$ ($\alpha = 0.014$)
$J = 2^+$ p,$\gamma(\theta)$

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112 (1955).

Level $Pd^{110}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; γ scin
0.370 *5* $\tau = 44^{\mu\mu s}$ ($\alpha = 0.014$)

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 98, 1308 (1955); 99, 617A (1955).

Level $Pd^{110}(p,p'\gamma)$ $E_p = 2.8$; γ scin
0.365 $\tau = 170^{\mu\mu s}$

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955); 99, 617A (1955)

Pd^{112} 46 66 21^{h}

U(28-Mev d, f) chem
β^- 0.28 *2* a$\beta\gamma$
γ 0.0185 *5** scin
(0.28 β)(0.018 γ) GM, scin
*Not identical with Ag K x ray crit a

R.H.Nussbaum, A.H.Wapstra, M.J.Stork, R.E.W. Kropveld, Physica 21, 77 (1955).

Ag 47

Levels Ag(p,p'γ) $E_p = 2.5$
~0.32 levels* $J = 3/2^-$ p,$\gamma(\theta)$
γ 0.325 *5* $\epsilon B(E2) = 0.22$ scin
E2/M1 = 0.036 or 1.3 p,$\gamma(\theta)$
~0.42 levels* $J = 5/2^-$ p,$\gamma(\theta)$
4.5† 0.104 *3* scin
100† 0.427 *5* $\epsilon B(E2) = 0.36$
*Averages for Ag^{107} and Ag^{109} levels

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112, 127 (1955).

$_{47}$Ag
Levels Ag(p,p'γ) E_p= 2.8; γ scin
0.315 $\epsilon B(E2)$ = 0.079
0.418 = 0.086

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955); 98, 249A (1955).

Levels Ag(p,p'γ) E_p = 3.0
γ 0.320 ~90% M1* $s\pi$ ce
0.420 E2* *From K/L

E.M.Bernstein, H.W.Lewis, Phys. Rev. 99, 617A (1955); verbal report.

γ Ag(n,n'γ) E_n ~2.7
0.332 1.99 scin
0.696 2.13
0.795 2.32
1.10 2.54

L.A.Rayburn, D.L.Lafferty, T.M.Hahn, Phys. Rev. 98, 701 (1955).

γ Ag(n,n'γ) E_n = 3.2 scin
0.74
1.10
1.50

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

$_{47}$Ag$^{107}_{60}$ stable
Levels Ag^{107}(p,p'γ) E_p = 5
Ag^{107}(α,α'γ) E_α = 5
γ 0.319 scin
0.419

L.W.Fagg, E.A.Wolicki, R.O.Bondelid, K.L.Dunning, S.Snyder, Phys. Rev. 98, 1538A (1955).

$_{47}$Ag$^{108}_{61}$ 2.3^m
Resonance Ag$^{(107)}$(n) E_n = 9 to 20 ev
(16.60 ev) σ_0 = 7300 chopper
J = 0 Γ = 0.11 *1* Γ_n/Γ = 0.35 *5*

C.Sheer, J.Moore, Phys. Rev. 98, 565 (1955).

Resonances Ag$^{(107)}$(n) E_n = 10 to 75 ev
E_0 (ev) mod cyc
(16.6) σ_0 = 2.6x10^3
41.8
45.3
51.7
See Ag^{110} for other Ag resonances

G.Grimm, L.J.Rainwater, W.W.Havens, Jr., Phys. Rev. 98, 1161A (1955); verbal report.

$_{47}$Ag$^{109}_{62}$ stable
Levels Ag^{109}(p,p'γ) E_p = 5
Ag^{109}(α,α'γ) E_α = 5
γ 0.306 scin
0.412

L.W.Fagg, E.A.Wolicki, R.O.Bondelid, K.L.Dunning, S.Snyder, Phys. Rev. 98, 1538A (1955).

$_{47}$Ag$^{110}_{63}$ 24^s g.s.
No ϵ_K (<10%) (See 270^d Ag) cryst

H.Jaffe, UCRL-2537 (1954).

$_{47}$Ag$^{110}_{63}$ 270^d
β^- 107+ 0.080 sl
32+ 0.314
153+ 0.530
γ 0.116 K/LM = 1.2 sl ce
0.447 0.706
0.618 0.759
0.655 0.883
0.687 0.932

T.Azuma, J. Phys. Soc. Japan 10, 167 (1955); Phys. Rev. 94, 638 (1954).

γ 0.657 α_K ~2x10^{-3} sl ce,pe
E2,M1

R.C.Rohr, R.D.Birkhoff, Phys. Rev. 98, 1266 (1955).

IT 5% 4π pc, cryst
x 2.5% Ag K x ray
1.2% Cd K x ray
No ϵ_K (<0.5%) (Pd K x ray <0.6%)

H.Jaffe, UCRL-2537 (1954).

$_{47}$Ag$^{110}_{63}$
Resonance Ag$^{(109)}$(n) E_n = 1.8 to 7 ev
(5.2 ev) σ_0 = 22,200 chopper
J = 1 Γ = 0.13 *2* Γ_n/Γ = 0.121 *7*

C.Sheer, J.Moore, Phys. Rev. 98, 565 (1951).

Resonance Ag$^{(109)}$(n,γ) mod cyc
(5.2 ev) $\sigma_0\Gamma^2$ = 345 ± 30
Assuming Γ_n/Γ = 0.11

E.Melkonian, Phys. Rev. 96, 1006 (1954); 86, 605A (1952).

Ag^{110}
47 63

Resonances $\mathrm{Ag}^{(109)}$(n) E_n = 10 to 75 ev
mod cyc

E_o (ev)
30.6
40.6
56.1
71.4

See Ag^{108} for other Ag resonances

G.Grimm, L.J.Rainwater, W.W.Havens, Jr., Phys. Rev. 98, 1161A (1955); verbal report.

Ag^{111}
47 64
7.50^d

μ -0.145 *1* M
$\nu(\mathrm{Ag}^{111})/\nu(\mathrm{Ag}^{109})$ = 1.11513 *5*
$\nu(\mathrm{Ag}^{111})/\nu(\mathrm{Ag}^{107})$ = 1.28728 *6*

G.K.Woodgate, R.W.Hellworth, Nature 176, 395 (1955).

Ag^{112}
47 65
3.2^h

21^hPd source chem scin

γ	100†	0.618 *5*	6†	1.83 *6*
	8†	1.10 *5*	9†	2.11 *4*
	20†	1.39 *4*	4†	2.51 *6*
	9†	1.62 *6*	2†	2.79 *8*

R.H.Nussbaum, A.H.Wapstra, M.J.Sterk, R.E.W.Kropveld, Physica 21, 77 (1955).

Cd ?
48

τ 2.4^s *1* Cd(pile n)
γ 0.160 scin

E.C.Campbell, R.W.Peelle, F.C.Maienschein, ORNL-1798, Sept. (1954).

Cd
48

Levels Cd(n,n′) E_n = 2.5
pc

0.86 *12*
1.27 *12*
1.63 *12*
1.84 *12*

Geneva Conf. 8/P/714 (1955), M.V.Pasechnik (USSR).

γ Cd(n,?γ) E_n = 3.2 scin

0.69†	0.57
0.02†	2.8

†σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Resonances Cd(n,γ) E_n = 0.025 to 500 ev
mod cyc

E_o (ev)	
0.177 *5*	Γ = 0.110 *5* ev
	$\sigma_o = 7.6\times10^3$ *3*
~19	$\sigma_o\Gamma \sim 3$
28	$\sigma_o\Gamma^2 = 9$
100	

Other unresolved resonances with $E_o > 100$

E.Meservey, Phys. Rev. 96, 1006 (1954); 86, 605A (1952).

Cd^{106}
48 58
stable

$\tau_{\beta\beta}$ $\geq 6\times10^{16y}$ Natural Cd cc
From absence of pairs of positrons

R.G.Winter, Phys. Rev. 99, 88 (1955).

Cd^{110}
48 62
stable

Level $\mathrm{Cd}^{110}(\alpha,\alpha'\gamma)$ E_α= 6.0; γ scin
0.654 *9* $\tau = 3.6^{\mu\mu s}$ (α = 0.003)

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 98, 1308 1308 (1955); 99, 617A (1955).

Cd^{111}
[illegible] 63
stable

0.247 level d 2.8^d In
μ -0.783 *28* $\gamma\gamma(\theta,H)$
Measurement independent of quadrupole interaction

R.M.Steffen, W.Zobel, Phys. Rev. 97, 1188 (1955).

0.247 level Single In crystal
μ -0.725 *47* $\gamma\gamma(\theta,H)$
$|q|$ ~1

H.Albers-Schönberg, E.Heer, T.B.Novey, P.Scherrer, Helv. Phys. Acta 27, 547, 637 (1954); J. phys. radium 16, 600, 605 (1955).

Level $\mathrm{Cd}^{111}(\alpha,\alpha'\gamma)$ E_α= 6.0; γ scin
0.340 *6* $\epsilon B(E2)$ = 0.16

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 98, 1308 (1955); 99, 617A (1955).

Level $\mathrm{Cd}^{111}(p,p'\gamma)$ E_p= 2.8; γ scin
0.330 $\epsilon B(E2)$ = 0.027

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955); 99, 617A (1955).

Cd^{111}
48 63
48.7^m

Cd^{110}(pile n)
(0.150 γ)(0.247 γ)(θ) $\eta(\pi)$ = 0.07 (no delay)
$\eta(\pi)$ studied as function of delay between two γ's shows effect of quadrupole interaction

P.Lehmann, J.Miller, Compt. rend. 240, 298 (1955).

Cd^{112}
48 64
stable

Level $\mathrm{Cd}^{112}(\alpha,\alpha'\gamma)$ E_α= 6.0; γ scin
0.620 *9* $\tau = 4.5^{\mu\mu s}$ (α = 0.003)

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 98, 1308 (1955); 99, 617A (1955).

Level $\mathrm{Cd}^{112}(p,p'\gamma)$ E_p= 2.8, γ scin
0.610 $\tau = 26^{\mu\mu s}$ (α = 0.003)

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955); 99, 617A (1955).

Cd^{113}
8 65

τ_β $\geq 3\times10^{15y}$ Natural Cd pc
From absence of negatrons; assuming $E_\beta \geq 0.2$

H.Selig, Thesis, Carnegie Inst. Tech. (1954).

Cd^{113} τ_β $\geq 5 \times 10^{14y}$ Natural Cd pc
48 65 From absence of negatrons; assuming $E_\beta \geq 0.2$

M.I.Kalkstein, Thesis, University of Chicago (1952).

Levels $\mathrm{Cd}^{113}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; γ scin
0.290 *5* $\epsilon B(E2) = 0.080$
0.550? < 0.14

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 98, 1308 (1955); 99, 617A (1955).

Level $\mathrm{Cd}^{113}(p,p'\gamma)$ $E_p = 2.8$; γ scin
0.290 $\epsilon B(E2) = 0.058$

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955); 98, 249A (1955); 99, 617A (1955).

Levels $\mathrm{Cd}^{112}(d,p)$ $E_d = 15.1$
g.s. $Q = 4.10$ *9* scin
0.55 *8*

N.S.Wall, Phys. Rev. 96, 664 (1954).

Cd^{114} Level $\mathrm{Cd}^{114}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; γ scin
48 66 0.550 *8* $\tau = 8^{\mu\mu s}$ $(\alpha = 0.0045)$
stable

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 98, 1308 (1955); 99, 617A (1955).

Level $\mathrm{Cd}^{114}(p,p'\gamma)$ $E_p = 2.8$; γ scin
0.545 $\tau = 41^{\mu\mu s}$ $(\alpha = 0.0045)$

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955); 98, 249A (1955); 99, 617A (1955).

Capture γ's $\mathrm{Cd}^{(113)}(n,\gamma)$ sl x(pe)

89+	0.557 *3*	10+	1.308 *8*
20+	0.651 *4*	13+	1.388 *8*
7+	0.728 *5*	5+	1.500 *15*
7+	0.803 *5*	6+	1.655 *10*
10+	1.215 *8*		

H.Motz, Phys. Rev. 99, 656A (1955).

Cd^{115} $\mathrm{Cd}^{(114)}(\text{pile } n,\gamma)$ chem
48 67 β^- 37% $\begin{cases}(0.59)\\(0.63)\end{cases}$ 63% $\begin{cases}(0.86)\\(1.11)\end{cases}$ sl
2.25^d
g.s.

γ	10†	0.230	220†	0.490	scin
	30†	0.260	430†	0.523	
	3†	0.263			

No 0.858 γ
$(0.860\,\beta)(0.260\,\gamma)$ $(0.260\,\gamma)(0.230\,\gamma,\ 0.263\,\gamma?)$
No $(E_\beta > 0.62)(0.490\,\gamma,\ 0.523\,\gamma)$
$x(0.490\,\gamma)/0.490\,\gamma = 0.03$

J.Varma, C.E.Mandeville, Phys. Rev. 97, 977 (1955).

Cd^{115} γ 10† 0.485 scin
48 67 74† 0.935
43^d 31† 1.30
No $0.12\,\gamma$, $0.450\,\gamma$, $0.500\,\gamma$ scin $\gamma\gamma$
$(0.485\,\gamma)(0.935\,\gamma)(\theta)$ ~isotropic
No $(1.30\,\gamma)\,\gamma$

J.Varma, C.E.Mandeville, Phys. Rev. 97, 977 (1955); Phys. Rev. 95, 613A (1954).

Cd^{116} $\tau_{\beta\beta}$ $\geq 1 \times 10^{17y}$ Natural Cd cc
48 68 From absence of pairs of negatrons
stable

R.G.Winter, Phys. Rev. 99, 88 (1955).

$\tau_{\beta\beta}$ $\geq 4 \times 10^{16y}$ 81% Cd^{116}; scin
From absence of peak at $E_{\beta\beta} \sim 3.5$

J.F.Detoeuf, R.Moch, Compt. rend. 241, 393 (1955).

Level $\mathrm{Cd}^{116}(\alpha,\alpha'\gamma)$ $E_\alpha = 6.0$; γ scin
0.508 *8* $\tau = 11^{\mu\mu s}$ $(\alpha = 0.0055)$

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 98, 1308 (1955); 99, 617A (1955).

In^{111} $(0.172\,\gamma)(0.247\,\gamma)(\theta)$ $\eta(\pi) = -0.181$ *5*
49 62 Influence of viscosity of solvent studied
2.8^d

R.M.Steffen, Phys. Rev. 99, 659A (1955).

In^{113} τ(L x ray) $> 10^{14y}$ pc
49 64 τ(K x ray) $> 10^{16y}$
stable

J.Heintze, Z. Naturf. 10a, 77 (1955).

In^{113} γ (0.392) $\alpha = 0.44$ ic
49 64 Authors conclude γ is E5 d 118^dSn
1.73^h

I.A.Antonova, I.V.Estulin, Izvest. Akad. Nauk Ser. Fiz. SSSR 18, 79 (1954); J. phys. radium 16, 534 (1955).

In^{114} γ (0.722) $E2/M1 = 0.044$ $\gamma\gamma(\theta)$
49 65 $(0.72\gamma)(0.56\gamma)(\theta)$ $J = 2,\ 2,\ 0$
72^s $(0.72\gamma)(0.56\gamma)$ delay $\leq 2.3 \times 10^{-10s}$
g.s.
Attenuation of angular correlation coefficients studied as a function of physical and chemical state of source. Results, together with limit on lifetime, indicate q ≥ 0.4 for the 0.56 level of Cd^{114}

S.C.Daubin, D.R.Hamilton, Phys. Rev. 99, 683 (1955).

In^{114}
49 65
72^s
g.s.

γ 100+ { (0.556) (0.572) } scin
50+ (0.722)
25+ 1.30
$(0.572\gamma)(0.722\gamma)(0.566\gamma)(\theta)$ J = 2, 4, 2, 0
$(0.572\gamma)(0.566\gamma)((\theta)$ isotropic

R.M.Steffen, J.N.Brazos, Phys. Rev. 99, 1646A, 1645A (1955).

In^{114}
49 65
$50^d + 72^s$

γ 100+ { (0.556) (0.572) } scin
100+ (0.722)
5+ 1.30
$(0.722\gamma)(0.556\gamma)(\theta)$ J = 4, 2, 0
$(0.722\gamma)(0.556\gamma)(\perp)$ J = 4+, 2+, 0+
Not compatible with J = 2, 2, 0
+Relative number of photons from $50^d + 72^s$In

J.N.Brazos, R.M.Steffen, Phys. Rev. 99, 1645A, 1646A (1955).

In^{114}
49 65

Resonances In^{113}(n) E_n = 3 to 150 ev

E_o (ev)	Γ_n (10^{-3}ev)*	E_o (ev)	Γ_n (10^{-3}ev)*
4.71 *4*	0.104 *16*	63.6 *10*	1.0 *4*
14.7 *1*[1]	7.7 *10*	70.6 *12*	4.7 *7*
21.7 *2*	4.4 *9*	82.5 *15*	2.9 *10*
25.2 *2*[2]	9.7 *16*	93.2 *18*	40 *8*
32.5 *4*	8.5 *10*	105 *2*	29 *9*
45.6 *6*	4.7 *12*	Others with E_o > 49 ev?	

*Based on $\overline{\Gamma}_\gamma$ = 0.080 ± 0.020 ev chopper
Γ_γ(measured) = ^{1}0.080 ± 0.020, ^{2}0.110 ± 0.040 ev

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

In^{115}
49 66
6×10^{14y}
g.s.

Level $\text{In}^{(115)}(p,p'\gamma)$ E_p = 3.0; γ scin
0.500 $\epsilon B(E2)$ = 0.058

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

γ $\text{In}^{(115)}(n,?\gamma)$ E_n = 3.2 scin

0.16+	0.77	0.10+	1.15
0.27+	0.88	0.16+	2.1

+σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

In^{115}
49 66
4.5^h

d 2.25^dCd chem
γ 0.335 α_K = 0.83 M4 sl, scin
K/LM = 3.85 L/M > 10

J.Varma, C.E.Mandeville, Phys. Rev. 97, 977 (1955).

γ (0.335) α = 0.82 lc
Authors conclude γ is E5 d 2.25^dCd

I.A.Antonova, I.V.Estulin, Izvest. Akad. Nauk Ser. Fiz. SSSR 18, 79 (1954); J. phys. radium 16, 534 (1955).

In^{116}
49 67
13^s

Resonance $\text{In}^{(115)}$(n)
(1.458 ev) J = 5*
*From dependence of σ on relative spin directions of aligned In nuclei and neutrons in partially polarized beam

J.W.T.Dabbs, L.D.Roberts, S.Bernstein, Phys. Rev. 98, 1512; 99, 1652A (1955).

Resonances $\text{In}^{(115)}$(n) cryst

E_o (ev)	σ_o	Γ_γ (ev)	Γ(ev)
1.456	38,500	0.072 ± 2	0.075
3.85	1,270	0.081 ± 4	0.081

H.H.Landon, V.L.Sailor, Phys. Rev. 98, 225A, 1267 (1955).

Resonances $\text{In}^{(115)}$(n) E_n = 0.3 to 12 ev

E_o (ev)	σ_o
1.458	39,100
3.86	
9.04	

J.Moore, Phys. Rev. 99, 61.A (1955); verbal report.

Resonances In^{115}(n) E_n = 3 to 150 ev

E_o (ev)	Γ_n (10^{-3}ev)*	E_o (ev)	Γ_n (10^{-3}ev)*
3.86 *4*	0.34 *3*	46.3 *6*	0.43 *9*
9.10 *9*[1]	1.73 *17*	48.6 *7*	0.65 *8*
12.1 *1*[2]	0.106 *13*	63.2 *10*	1.1 *3*
23.0 *2*	1.0 *2*	83.3 *15*	11 *2*
39.9 *5*[3]	3.5 *4*	95 *2*	2.8 *6*

Other resonances with E_o > 56 ev? chopper
*Based on $\overline{\Gamma}_\gamma$ = 0.077 ± 0.015 ev
Γ_γ(measured) = ^{1}0.080 ± 0.040, ^{2}0.140 ± 0.060, and ^{3}0.140 ± 0.050 ev

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

In^{117}
49 68
1.1^h
g.s.

τ 1.1^h *1* d 3.0^hCd chem
β^- 0.74 *1* sl
γ 0.161 *1* scin, sl ce
0.565 *7* $\alpha \sim 0.005$
No 0.726γ (< 1% of 0.565γ) scin
$(0.565\gamma)(\beta, 0.161\gamma)$
Not p 14^dSn (< 1%)

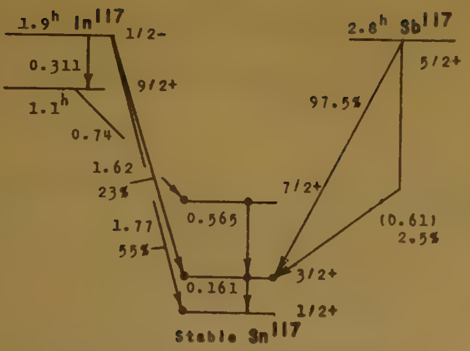
C.L.McGinnis, Phys. Rev. 97, 93 (1955); 94, 780A (1954).

In^{117}
49 68
1.9^h

τ 1.90^h *5* d 50^mCd chem
β^- 23% 1.616 *5* sl
55% 1.772 *5*
γ 0.161 *1* α_K = 0.01 scin, sl ce
K/LM = 8.3
22% 0.311 *2* α_K = 1.3 M4
$\beta(0.161\gamma)$ No $(0.311\gamma)(\beta,\gamma)$
p 1.1^hIn 22% Not d 3.0^hCd (< 10%)

(Continued)

In^{117}
$_{49}$ 68



C.L.McGinnis, Phys. Rev. 97, 93 (1955).

$_{50}Sn$

γ Sn(n,?γ) $E_n = 3.2$ scin

0.14†	0.69
1.67†	1.14
0.21†	2.0

†σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Sn(p,p'γ) $E_p \leq 2.75$

No γ with $E_\gamma < 0.6$ scin

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

Sn^{109}
$_{50}$ 59
18^m

τ 18^m *2* Cd^{106}(15-Mev α,n) chem
β^+ trochoid s
γ 0.073 sl ce
0.678
p 4.3^hIn

M.D.Petroff, S.W.Mead, W.O.Doggett, Phys. Rev. 98, 279A (1955).

Sn^{113}
$_{50}$ 63
118^d

Resonances Sn^{112}(n) E_n = 10 to 500 ev

E_o (ev)	$\Gamma_n(10^{-3}ev)$*
96.5 *20*	85 *10*
280 *9*	36 *17*

*Based on $\overline{\Gamma}_\gamma = 0.11 \pm 0.03$ ev chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955); 95, 645A (1954).

Sn^{115}
$_{50}$ 65
stable

Resonance Sn^{114}(n) E_n = 10 to 500 ev

E_o (ev)	$\Gamma_n(10^{-3}ev)$*
280 *9*	450 *9*

No other strong resonance chopper

*Based on $\overline{\Gamma}_\gamma = 0.11 \pm 0.03$ ev

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Sn^{116}
$_{50}$ 66
stable

Resonance Sn^{115}(n) E_n = 10 to 500 ev

E_o (ev)	$\Gamma_n(10^{-3}ev)$*
290 *10*	260 *130*

Possibly additional weak resonances with
$92 < E_o < 210$ ev chopper

*Based on $\overline{\Gamma}_\gamma = 0.11 \pm 0.03$ ev and g = 1/2

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Sn^{117}
$_{50}$ 67
stable

Resonances Sn^{116}(n) E_n = 10 to 500 ev

E_o (ev)	$\Gamma_n(10^{-3}ev)$*
112 *2*	58 *6*
149 *4*	4.5 *14*

*Based on $\overline{\Gamma}_\gamma = 0.11 \pm 0.03$ ev chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955); 95, 645A (1954).

Sn^{118}
$_{50}$ 68
stable

Resonances Sn^{117}(n) E_n = 10 to 500 ev

E_o (ev)	$\Gamma_n(10^{-3}ev)$*
39.4 *5*[1]	5.4 *5*
122 *3*	15 *3*
125 *3*	2.8 *8*
197 *6*	35 *9*
259 *8*	12 *4*
343 *13*	80 *60*
425 *18*	190 *80*
460 *20*	120 *70*

*Based on $\overline{\Gamma}_\gamma = 0.11 \pm 0.03$ ev and g = 1/2

Γ_γ(measured) = [1]0.106 ± 0.025 ev chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955); 95, 645A (1954).

Sn^{119}
$_{50}$ 69
stable

Resonances Sn^{118}(n) E_n = 10 to 500 ev

E_o (ev)	$\Gamma_n(10^{-3}ev)$*
46.3 *6*	0.7 *2*
368 *14*	420 *30*

*Based on $\overline{\Gamma}_\gamma = 0.11 \pm 0.03$ ev chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955); 95, 645A (1954).

Sn^{120}
$_{50}$ 70
stable

Resonances Sn^{119}(n) E_n = 10 to 500 ev

E_o (ev)	$\Gamma_n(10^{-3}ev)$*
141 *3*	30 *12*
222 *7*	24 *6*
460 *20*	200 *70*

*Based on $\overline{\Gamma}_\gamma = 0.11 \pm 0.03$ ev and g = 1/2

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955); 95, 645A (1954).

Sn^{121} 50 71 27^{h}
Resonance Sn^{120}(n) E_n = 10 to 500 ev

E_o(ev)	Γ_n(10^{-3}ev)*
425 *18*	44 *18*

*Based on $\overline{\Gamma}_\gamma = 0.11 \pm 0.03$ chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955); 95, 645A (1954).

Sn^{123} 50 73 136^{d}
Sn^{122}(n) E_n = 10 to 500 ev
No resonances observed chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Sn^{125} 50 75 9.9^{d}
τ 9.7^{d} Sn^{124}(pile n,γ) chem
β^- ~0.4 a $\beta\gamma$ scin
~1.3 a $\beta\gamma$ scin
~2.4 a
γ 0.34 *1* 1.07 *1* scin
0.47 *1* 1.41 *2*
0.81 *1* 1.97 *2*
0.90 *1*
(1.07γ)(0.34γ, 0.47γ, 0.81γ, 0.90γ) scin
(0.47γ)(1.07γ, 1.41γ) (1.41γ)(0.47γ)
No (E_γ > 1.5) γ

S.B.Burson, J.M.LeBlanc, D.W.Martin, Phys.Rev. 99, 660A (1955); verbal report.

Sn^{125} 50 75 9.5^{m}
τ 9.4^{m} Sn^{124}(pile n,γ) chem
γ 0.326 scin
0.64
1.07
1.39
(0.326γ)(1.39γ) (1.07γ)(0.64γ) scin

S.B.Burson, J.M.LeBlanc, D.W.Martin, Phys. Rev. 99, 660A (1955); verbal report.

Levels Sn^{124}(d,p) E_d = 15.1
g.s Q = 3.52 *7* scin
1.16 *8*
2.77 *10*
3.41 *10*
4.09 *10*

N.S.Wall, Phys. Rev. 96, 664 (1954).

Sn^{125} 50 75
Resonance Sn^{124}(n) E_n = 10 to 500 ev

E_o(ev)	Γ_n(10^{-3}ev)*
62.5 *9*	12 *2*

*Based on $\overline{\Gamma}_\gamma = 0.11 \pm 0.03$ ev chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955); 95, 645A (1954).

$\mathrm{Sn}^{130?}$ 50 80 57^{m}
τ 57^{m} *2* U(30-Mev d, f) chem
p 10^{m}Sb chem U(n, f) chem

I.Fränz, J.Rodriquez, M.Carminatti, Z. Naturf. 10a, 82 (1955).

Sb 51
Sb(p,p'γ) $E_p \leq 2.75$
No γ with E_γ < 0.6 scin

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

Sb^{116} 51 65 60^{m}
τ 60^{m} $\mathrm{In}^{(115)}$(26-Mev α,3n) chem
γ 15† 0.41 *2* scin
130† 0.95 *5*
150† 1.31 *5*
Yield 15.5^{m}Sb/60^{m}Sb ~const. for E_α = 26 to 52
†Photons per 100 β^+

A.H.W.Aten, Jr., J.Manassen, G.D.de Feyfer, Physica 20, 665 (1954).

Sb^{116} 51 65 15.5^{m} g.s.
τ 14^{m} $\mathrm{In}^{(115)}$(26-Mev α,3n) chem
β^+ 2.4 *2* a
γ 2.2 *1* scin
Lower energy γ's probably present
Yield 15.5^{m}Sb/60^{m}Sb ~ const. for E_α = 26 to 52

A.H.W.Aten, Jr., J.Manassen, G.D.de Feyfer, Physica 20, 665 (1954).

$\mathrm{Sn}^{(116)}$(6.7-Mev p,n) chem
β^+ 1.5 scin $\beta\gamma$
2.4
γ 31† 0.90 *2* scin
92† 1.305 *15*
8† 2.215 *20*
(1.30γ)(0.90γ, 2.4β)
(1.5β)(0.90γ, 1.30γ, 2.21γ)

P.Staehelin, D.Maeder, M.Pochon, Z.Phys. 140, 498 (1955).

Sb^{117} 51 66 2.8^{h}
$\mathrm{In}^{(115)}$(22-Mev α, 2n)
γ 0.161 K/LM = 8.3 scin, sl ce
No 0.565γ (< 0.5%)
β^+/ϵ = 0.026 from $\gamma^\pm$(0.161γ)/(0.161γ) = 0.05
indicating E_{β^+}(allowed) = 0.61
No ϵ to g.s. (< 5%) from xγ/x = 0.68
For decay scheme see page 77

C.L.McGinnis, Phys. Rev. 97, 93 (1955).

Sb^{118} 51 67 5.1^{h}
β^+ 0.7 6^{d}Te source; a $\beta\gamma$
(0.7β)γ
d $3.5^{m}\mathrm{Sb}^{118}$?

R.W.Fink, Thesis, Univ. of Rochester, 1953.

Sb^{118} 51 67 3.5^{m}
β^+ 3.10 *5* 6^{d}Te source; a
γ 0.108 a ce
No (3.10β)γ
0.108γ assumed IT to 5.1^{h}Sb

R.W.Fink, Thesis, Univ. of Rochester 1953.

Sb^{120}
51 69
16.4^{m}
g.s.

γ 1.18 scin
$(1.18\gamma)/\beta^{+} = 0.03$ $\mathrm{Sb}^{(121)}(\leq 50\text{-Mev }\gamma,n)$

C.L.McGinnis, Phys. Rev. 98, 1172A (1955).

Sb^{120}
51 69
5.8^{d}

τ 5.8^{d} *2* $\mathrm{Sn}^{119}(15\text{-Mev }d,n)$chem
γ 1770* 0.090 *1* K/LM = 8.5 E1 sl ce
1000* 0.200 *1* K/LM = 4.6 E2
10.4* 1.035 *5* E2
7.8* 1.180 *5* E2
$(0.09\gamma)(0.20\gamma)(\theta)$ $\Delta J = 1(D), 2(Q)$ scin
$(0.20\gamma)(\sim 1.1\gamma)(\theta)$ $\Delta J = 2(Q), 2(Q)$
$(1.04\gamma)(1.18\gamma)(\theta)$ J = 4, 2, 0
$x(0.09\gamma,\ 0.20\gamma,\ \sim 1.1\gamma)$ delay = $11^{\mu s}$**
Not p 16.4^{m}Sb ($\beta^{+} < 0.3\%$) scin
*Relative intensity ce

C.L.McGinnis, Phys. Rev. 98, 1172A (1955);
**verbal report.

Sb^{121}
51 70
stable

$q(\mathrm{Sb}^{123})/q(\mathrm{Sb}^{121}) = 1.2747$ quad res
Indications for existence of nuclear hexadecapole moment, q_4; interaction constant $= 30 \pm 5$ kc/sec

T.C.Wang, Phys. Rev. 99, 566 (1955).

Sb^{122}
51 71
2.75^{d}
g.s.

ϵ_K 2.6% (Sn K x ray 2.2%) 4π pc, cryst

H.Jaffe, UCRL-2537 (1954).

γ 0.570 $\alpha_K = 7\times10^{-3}$ sl ce,pe
K/LM = 2.3 ± 0.4 E2, M1

R.C.Rohr, R.D.Birkhoff, Phys. Rev. 98, 1266 (1955).

β 12% 0.72 *2* $\mathrm{Sb}^{(121)}(\text{pile } n,\gamma)$; sl
7% 0.90 *5*
60% 1.41 *1* F-K plot linear
21% 1.97 *1* $\Delta J = 2$, yes shape

γ 0.558 sl pe
[redacted]

$(1.41\beta,\ \sim 0.90\beta)\gamma$ sl
$(0.90\beta,\ 0.72\beta)(1.1\text{–}1.2\gamma)$
$(E_\beta = 0.3)(0.56\gamma,\ 0.69\gamma)$
$(E_\beta = 1.1)(0.56\gamma)$, no $(E_\beta = 1.1)(0.69\gamma)$

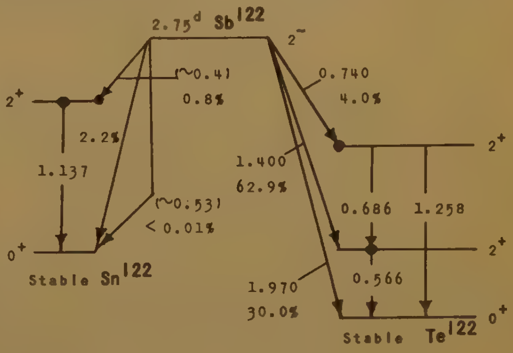
J.Moreau, Compt. rend. 239, 1130 (1954).

Sb^{122}
51 71
2.75^{d}
g.s.

β^{-} 4.3% 0.730 *20* $\mathrm{Sb}^{121}(\text{th } n,\gamma)$; sl
67.0% 1.423 *10*
25.7% 1.987 *20* $\Delta J = 2$, yes shape
β^{+} ~0.01% (0.53 *5*)* $\gamma\gamma(\theta)$
ϵ 3.0% Sn x_K/β, crit a
γ 73% 0.563 *5* $\alpha_K = 0.0054$ sl pe, ce
3.6% 0.693 *7* E2/M1 ~ 10 scin $\gamma\gamma(\theta)$
0.75% 1.152 *15* sl pe, scin
0.8% 1.256 *12*
$(0.1 < E_\beta < 0.9)(1.256\gamma)$ No $(1.15\gamma)\gamma$ scin
(Sn K x ray)(1.15γ) crit a, scin
$(0.69\gamma)(0.56\gamma)(\theta)$ J = 2, 2, 0
*Using $\epsilon/\beta^{+} = 300 \pm 130$ assuming $\Delta J = 2$, yes

M.J.Glaubman, Phys. Rev. 98, 645; 97, 1172A; 99, 659A (1955).

β^{-} 4.0% 0.740 *20* $\mathrm{Sb}^{121}(\text{pile } n,\gamma)$; sl
62.9% 1.400 *10*
30.0% 1.970 *5* $\Delta J = 2$, yes shape
No β^{+} (< 0.1%) sl
ϵ 3.1% Sn x_K/γ, pc
γ 66% 0.566 *4* $\alpha_K = 0.0052$ sl pe, ce
3.4% 0.686 *4* sl pe, scin
0.73% 1.137 *6*
0.66% 1.258 *6* No other γ $s\pi$ ce
$\epsilon_K/0.56\gamma = 0.041$ (Sn K x ray/0.56γ) scin, pc
$(0.69\gamma)(0.56\gamma)$ (1.137γ) x scin



B.Farrelly, L.Koerts, N.Benczer, R.van Lieshout, C.S.Wu, Phys. Rev. 99, 1440; 98, 1172A (1955).

Sb^{122}
51 71
3.5^{m}

$\mathrm{Sb}^{121}(\text{pile } n,\gamma)$
γ 0.0607 scin, $s\pi$ ce
0.0753 E3, M3 from τ of 3.5^{m}
$(\sim 0.065\gamma)$x scin

J.M.LeBlanc, J.M.Cork, S.B.Burson, Phys. Rev. 98, 39 (1955).

Sb^{122}
51 71

Resonances $\mathrm{Sb}^{121}(n)$ chopper

E_0 (ev)	Γ_n (10^{-3}ev)	Γ_γ (10^{-3}ev)
6.23	2.4	69
15.3	5.0	125
29.7	2.4	126

A.Stolovy, J.A.Harvey, Phys. Rev. 99, 611A (1955); priv. comm.

Sb^{123} 51 72 stable?

Indications for existence of nuclear hexadecapole moment, q_4; interaction constant = 24 ± 5 kc/sec

T.C.Wang, Phys. Rev. 99, 566 (1955).

τ_β $\geq 1 \times 10^{13y}$ Natural Sb chem; pc
From absence of negatrons; assuming $E_\beta \geq 0.05$

H.Selig, Thesis, Carnegie Inst. Tech. (1954).

Sb^{124} 51 73 60^d

β^- sl
12% 0.28
56% 0.63
4% 1.07
6% 1.68
22% 2.39*

γ sl ce
0.605
0.650
0.720
1.69
2.10

*Spectrum shape can be fitted by S,T interaction with $\Delta J = 1$, yes

T.Azuma, J. Phys. Soc. Japan 10, 167 (1955).

No ϵ_K (<0.1%) (K x ray ~0.4%) 4π pc

M.Jaffe, UCRL-2537 (1954).

Resonance Sb^{123}(n) chopper

E_0 (ev)	Γ_n (10^{-3}ev)	Γ_γ (10^{-3}ev)
21.4	25	89

A.Stolovy, J.A.Harvey, Phys. Rev. 99, 611A (1955); priv. comm.

$Sb^{130?}$ 51 79 10^m

τ 10.3^m *3* d 57^mSn chem
β^- 2.9

I.Fränz, J.Rodriquez, H.Carminatti, Z.Naturf. 10a, 82 (1955).

$_{52}$Te

γ Te(n,?γ) E_n = 3.2 scin
0.72 1.43
1.10 2.3

V.E.Scherrer, S.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

$_{52}$Te

Te(p,p'γ) $E_p \leq 2.75$
No γ with $E_\gamma < 0.6$ scin

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

$Te^{116?}$ 52 64

τ $2\text{-}4^h$? I^{127}(240-Mev p) chem
p 10-20^{m}Sb chem

B.Dropesky, E.O.Wiig, (1953), unpublished.

Te^{117} 52 65 2.5^h

τ 2.5^h I^{127}(240-Mev p) chem
β^+ 2.5 *1* s
p 2.8^hSb chem

B.Dropesky, E.O.Wiig, (1952), unpublished.

Cs^{133}(240-Mev p) chem
β^+ 2.5 *1* s

R.W.Fink, E.O.Wiig, (1952), unpublished.

Te^{118} 52 66 6^d

τ 6.0^d I^{127}(240-Mev p) chem
p 3.5^mSb chem

B.Dropesky, E.O.Wiig, (1952), unpublished.

Te^{119} 52 67 16^h

τ 16^h *2* I^{127}(240-Mev p) chem
γ 0.56 s ce
No β^+ d 18^mI, p 39^hSb chem

B.Dropesky, Thesis, Univ. of Rochester (1953).

τ 16^h *2* Cs^{133}(240-Mev p) chem
No strong β^+ Probably d 18^mI

R.W.Fink, Thesis, Univ. of Rochester (1953).

Te^{123} 52 71 stable?

τ_{ϵ_K} $\geq 1.8 \times 10^{12y}$ Natural Te pc

M.I.Kalkstein, Thesis, University of Chicago (1952).

τ_{ϵ_L} $\geq 5 \times 10^{13y}$ Natural Te chem; pc

H.Selig, Thesis, Carnegie Inst. Tech. (1954).

Te^{123} 52 71 stable?
τ(L x ray) $>10^{13y}$ pc
τ(K x ray) $>10^{15y}$

J.Heintze, Z. Naturf. 10a, 77 (1955).

$Te^{123}(p,p'\gamma)$ $E_p = 5$
$Te^{123}(\alpha,\alpha'\gamma)$ $E_\alpha = 5$
γ 0.159 0.435 scin
0.274 0.500
0.342
$(0.159\gamma)(0.274\gamma, 0.342\gamma)$ No$(0.274\gamma)(0.342\gamma)$

L.W.Fagg, E.A.Wolicki, R.O.Bondelid, K.L.Dunning, S.Snyder, Phys. Rev. 98, 1538A (1955); verbal report

Te^{125} 52 73 stable
$Te^{125}(p,p'\gamma)$ $E_p = 5$
$Te^{125}(\alpha,\alpha'\gamma)$ $E_\alpha = 5$
γ 0.439 scin

L.W.Fagg, E.A.Wolicki, R.O.Bondelid, K.L.Dunning, S.Snyder, Phys. Rev. 98, 1538A (1955); verbal report.

Te^{129} 52 77 72^m
$Te^{(128)}$(26-Mev d,p) chem
γ 9% 0.435 *20* d 4.6^hSb chem; scin
0.7% 1.08 *4*

C.A.Mallmann, A.H.W.Aten, Jr., D.R.Bes, C.M.de McMillan, Phys. Rev. 99, 7 (1955).

Te^{130} 52 78
τ_β $\geq 4 \times 10^{16y}$ Natural Te chem; pc
From absence of negatrons

H.Selig, Thesis, Carnegie Inst. Tech. (1954).

Te^{131} 52 79 25^m g.s.
β^- 15% 1.35 Te^{130}(slow n,γ)
25% 1.69 1.2^dTe source; sl
60% 2.14
γ (0.147) scin
(0.446)
(0.773)
γ's assigned here. Also observed in 1.2^dTe
Decay scheme proposed

E.Hebb, Phys. Rev. 97, 987 (1955).

$Te^{(130)}$(26-Mev d,p) chem
γ 100+ 0.145 *10* scin
24+ 0.450 *10*
~6+ 0.595 *15*
~4+ 0.950 *15*
~8+ 1.140 *20*
$0.145\gamma/\beta \sim 1$ GM

C.A.Mallmann, A.H.W.Aten, Jr., D.R.Bess, C.M. de McMillan, Phys. Rev. 99, 7 (1955).

Te^{131} 52 79 1.2^d
β^- 52% 0.42 Te^{130}(11-Mev d,p) chem
17% 0.57 sl
4.6% 0.98
4.7% 2.46
γ ~22% 0.180 *2* IT K/LM = 2.4 M4 sl ce
0.051 *2?* st 0.446 *4* sl pe
0.099 *1* 0.575 *12*
st 0.147 *1* st 0.773 *8*
0.239 *9* 0.842 *13*
0.275 *9* 1.12 *1*
st 0.331 *5* w 1.63 *2* ?
$(0.773\gamma)(1.12\gamma, 0.842\gamma?)$ No$(0.331\gamma)(0.773\gamma)$
Decay scheme proposed

E.Hebb, Phys. Rev. 97, 987 (1955).

$Te^{(130)}$(26-Mev d,p) chem
γ 100+ 0.145 *10* scin
> 100+ 0.770 *20*
> 10+ 1.140 *20*

C.A.Mallmann, A.H.W.Aten, Jr., D.R.Bess, C.M. de McMillan, Phys. Rev. 99, 7 (1955).

I^{119} 53 66 [illegible]^m
τ 17^m *2* I^{127}(240-Mev p) chem
p 16^hTe chem

B.Dropesky, Thesis, Univ. of Rochester (1953).

I^{120} 53 67
τ $\geq 1.1^h$ I^{127}(240-Mev p) chem
β^+ 4.0 *2* s

B.Dropesky, Thesis, Univ. of Rochester (1953).

τ $>1.3^h$ Cs^{133}(100-Mev p) chem
β^+ 4.0 *2* s

R.W.Fink, Thesis, Univ. of Rochester (1953).

I^{121} 53 68 1.5^h
τ 1.6^h *1* Cs^{133}(240-Mev p) chem
β^+ 1.13 *5* s
γ 0.213 s ce
p 17^dTe chem

R.W.Fink, Thesis, Univ. of Rochester (1953).

I^{126} 53 73 13.3^d
Te^{126}(14-Mev d,2n), I^{127}(fast n,2n) chem
β^- 5.8% 0.385 *5* sl $\beta\gamma$
29% 0.865 *5* sl $\beta\gamma$
9.3% 1.250 *10* $\Delta J = 2$, yes shape sl
β^+ 0.28% 0.460 *15*
ϵ 45.3% Te x_K/γ, pc

(Continued)

I^{126}
53 73
13.3^{d}

	0.96%	1.110	*20*	$\Delta J = 2$, yes shape	sl
γ	34%	0.386	*2*	$\alpha_K = 0.017$	sl ce
	5.0%	0.48	*1*		scin
	33%	0.65	*1*		
	3.6%	0.75	*2*		
	0.8%	0.86	*2*		
	<0.5%	(1.42)			

$\epsilon_K/0.65\gamma = 1.46$ (Te K x ray/0.65γ) scin, pc
$(0.386\gamma)(0.48\gamma)$ $(0.65\gamma)(0.75\gamma)$ scin
$(0.65\gamma, 0.75\gamma)$x $(0.65\gamma)\gamma^{\pm}$

L.Koerts, P.Macklin, B.Farrelly, R.van Lieshout, C.S.Wu, Phys. Rev. 98, 1230, 1172A (1955).

I^{127}
53 74
stable

Level $\mathrm{I}^{127}(p,p'\gamma)$ $E_p = 2.0$; γ scin
0.212

H.Mark, C.McClelland, C.Goodman, Phys. Rev. 98, 1245 (1955).

Level $\mathrm{I}^{127}(n,n'\gamma)$ $E_n = 0.2$ to 2
(0.20) γ scin
Yield indicates direct decay to g.s.

J.B.Guernsey, A.Wattenberg, Phys. Rev. 98, 1146A (1955); verbal report.

Levels $\mathrm{I}^{127}(n,n'\gamma)$ $E_n = 0.2$ to 1.0

γ	0.062 *2*	0.632 *6*	scin
	0.208 *2*	0.725 *10*	
	0.390?	1.000?	
	0.435		

D.A.Lind, J.J.Van Loef, Phys. Rev. 99, 621A; verbal report; Phys. Rev. 98, 224A (1955).

γ $\mathrm{I}^{127}(n,n'\gamma)$ $E_n = 3.2$ scin

	0.21	st	0.63
	0.33		1.04 ?
st	0.42		

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

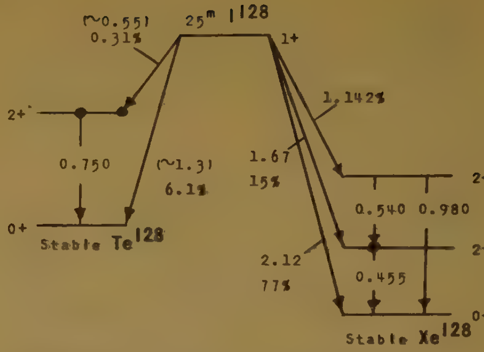
I^{128}
53 75
25.0^{m}

β^-	1.9%	1.140	*20*				sl
	14.8%	1.665	*15*				
	76.9%	2.120	*10*				
No β^+							sl, scin
ϵ	6.4%						Te x_K/γ, pc
γ	1000+	0.455	*5*	17+	0.750	*7*	scin
	94+	0.540	*5*	18+	0.980	*10*	

$\beta^-/0.455\gamma = 5.0 \pm 0.5$ sl, scin
$\epsilon_K/0.455\gamma = 0.316$ (Te x ray/0.455γ) pc, scin
$(0.455\gamma)(0.540\gamma)$ (0.750γ) x scin

(Continued)

I^{128}
53 75
25^{m}



N.Benczer, B.Farrelly, L.Koerts, C.S.Wu, Phys. Rev. 100, 955A (1955); priv. comm.

I^{132}
53 79
2.26^{h}

τ 2.259^{h} *8* d 78^{h}Te chem lc

E.W.Emery, N.Veall, Nature 174, 889 (1954).

τ 2.30^{h} *5* U(14-Mev n, f) chem

A.C.Wahl, Phys. Rev. 99, 730 (1955).

I^{133}
53 80
20.8^{h}

τ 20.9^{h} *3* U(14-Mev n, f) chem

A.C.Wahl, Phys. Rev. 99, 730 (1955).

I^{134}
53 81
53^{m}

τ 52.4^{m} U(14-Mev n, f) chem

A.C.Wahl, Phys. Rev. 99, 730 (1955).

I^{135}
53 82
6.7^{h}

τ 6.75^{h} U(14-Mev n, f) chem

A.C.Wahl, Phys. Rev. 99, 730 (1955).

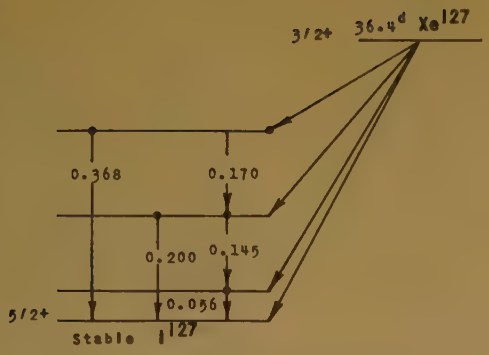
Xe^{127}
54 73
36.4^{d}

γ		0.056	I^{127}(32-Mev p,n)	chem
	vw	0.145		scin
		0.170		
	st	0.200		
		0.368		

No β^+ (no $\gamma^{\pm}$) K x ray scin
$(0.056\gamma)(0.145\gamma, 0.170\gamma$, K x ray)
$(0.200\gamma)(0.170\gamma$, K x ray)
(0.368γ)(K x ray) No$(0.368\gamma)\gamma$
No$(0.200\gamma)(0.056\gamma, 0.145\gamma)$

(Continued)

Xe^{127}
54 73
36.4^d



M.B.Mathur, Phys. Rev. 97, 707 (1955).

Xe^{135}
54 81
9.2^h

β^- ~3% 0.550 U(n, f) ms; sl $\beta\gamma$
97% (0.910)

γ 100+ 0.250 scin
~0.1+ 0.36
3+ 0.604 *6*

$(0.550\ \beta)(0.60\ \gamma)$ $(ce_K\ 0.250\ \gamma)(0.36\ \gamma)$ sl
No $(ce_K\ 0.250\ \gamma)(0.60\ \gamma)$

S.Thulin, Arkiv Fysik 9, 137 (1955); Phys. Rev. 94, 734 (1954).

Xe^{136}
54 82
stable

Resonance Xe^{135}(n) E_n = 0.01 to 0.5 ev
0.084 ev Γ = 0.10 ev
σ(peak) = 3.3×10^6 $g\Gamma_n$ = 0.011 ev
From preliminary fit to 1954 chopper data

Geneva Conf. 8/P/591 (1955), written by S.Bernstein, E.C.Smith (USA). See Appendix.

Xe^{137}
54 83
3.9^m

β^- 3.5 U(d, f) I chem; a
γ

S.J.Nassif, W.Seelmann-Eggebert, Z.Naturf. 10a, 83 (1955).

Xe^{138}
54 84
17^m

U(30-Mev d, f) chem
β^- 2.4
E_γ/β = 1.3 Mev

S.J.Nassif, W.Seelmann-Eggebert, Z. Naturf. 10a, 83 (1955).

U(n, f) ms but 33^mCs d present
γ 100+ 0.42 *2* 1.78 *3* scin
20+ 0.51 *2* 2.01 *3*

S.Thulin, Arkiv Fysik 9, 137 (1955).

Cs^{126}
55 71
1.6^m

τ 1.6^m *2* d 96^mBa chem; ms
β^+ 3.8 *4* a, scin

γ 0.385 *5* scin
No 0.48 γ(< 10% of 0.385 γ)
No γ with E_γ > 0.6(< 13% of 0.385 γ)
$\beta^+ : x : \gamma$ = 82 : 18 : 38
$(0.385\ \gamma)(\gamma^\pm, \ll 3\text{-Mev}\ \beta^+)$
No $(0.385\ \gamma)(3.8\ \beta^+)$

M.I.Kalkstein, J.M.Hollander, Phys. Rev. 96, 730 (1954).

Cs^{128}
55 73
3.8^m

β^+ 3+ 1.5 d 2.4^dBa sl
30+ 2.5
70+ 3.0
β^+/ϵ = 3.1
γ 0.445 α = 0.016 scin, sl ce
0.980

J.M.Hollander, M.I.Kalkstein, Phys. Rev. 98, 260A (1955).

Cs^{129}
55 74
31^h

Ta^{181}(340-Mev p) chem
γ 100+ 0.375 *10* scin
9+ 0.420 *10*
23+ 0.585 *20*

W.E.Nervik, G.T.Seaborg, Phys. Rev. 97, 1092 (1955).

Cs^{133}(80-Mev p, p 4n) chem
γ 0.395 *10* scin
0.550 *30*

B.L.Robinson, R.W.Fink, Phys. Rev. 98, 231A, 221 (1955).

Cs^{131}
55 76
10^d

J 5/2 M
μ +3.48 *4*

E.H.Bellamy, K.F.Smith, Phil. Mag. 44, 33 (1953).

Cs^{132}
55 77
6.2^d

Cs^{133}(80-Mev p, pn) chem
τ 6.2^d *2*

γ 1000+ 0.669 *3* scin
7+ 1.10 *4*
8+ 1.26 *2*
$(0.669\ \gamma)(E_\gamma > 0.7)$ No $(0.669\ \gamma)(1.26\ \gamma)$
No ϵ to g.s. (<20%) $x\gamma/\gamma$

B.L.Robinson, R.W.Fink, Phys. Rev. 98, 231A (1955).

Cs^{133}
55 78
stable

μ +2.56421 I
$\nu(\mathrm{Cs}^{133})/\nu(\mathrm{H}^2) = 0.854496$ *18*

H.E.Walchli, ORNL-1775 (1954).

Cs^{134}
55 79
2.3^y
g.s.

J 4 M
μ +2.95 *1*

E.H.Bellamy, K.F.Smith, Phil. Mag. 44, 33 (1953).

No ϵ_K (<0.2%) (No Xe K x ray) 4π pc, cryst

H.Jaffe, UCRL-2537 (1954).

β^-	~32%	0.083 3	50%	0.655 2	sl
	~5%	0.31* 10	~13%	0.683 4	

— No ϵ (<1%, from absence of e_A) sl

			ce_K**	sl pe, ce
γ	2†	0.473 2	3	K/L
	9†	0.563 1	11.9	
	13†	0.569 1	26	
	100†	0.605 1	100	7.7
	91†	0.796 1	44	7.0
	18†	0.801 2	3.9	K/LM
	0.9†	1.038 5	0.43	~7
	3.0†	1.168 5	0.49	~6
	4.6†	1.367 5	0.49	~10

0.203 γ not found (photons <0.2†, ce_K <1.2**)
0.663 γ seen, probably Cs^{137}
No $\gamma\gamma$ delay ($<0.2^{\mu s}$) scin
$(0.796\,\gamma)(E_\beta > 0.1)/(0.605\,\gamma)(E_\beta > 0.1) = 1.3 \pm 0.2$
Few, if any, (high E_β) (~0.566 γ)
*Mean value for 2 components
**Relative intensity of ce_K

G.L.Keister, E.B.Lee, F.H.Schmidt, Phys. Rev. 97, 451 (1955); 86, 632A (1952).

β^-	25%	0.088 4	Cs^{133} (slow n,γ);	s
	75%	0.654 6		

			a	K/LM
γ	10†	0.563 2	0.004	
	18†	0.569 2	0.006	
	100†	0.604 2		7.0
	100†	0.796 3		8.4
	8†	0.802 3	0.0026	
	1.1†	1.038 4?	0.002	7.6
	1.7†	1.166 4?	0.0015	8.4
	2.8†	1.367 4	0.0014	10.0

No β^+ (<0.1%)

A.A.Bashilov, N.M.Anton'eva, M.V.Blinov, B.S.Dzhelepov, Izvest. Akad. Nauk Ser. Fiz. SSSR 18, 43 (1954).

Cs^{134}
55 79
2.3^y
g.s.

β^-	25%	0.078 5	5%	0.410 15	sl
	2%	0.210 5	68%	0.657 5	

		a	sl pe, ce
γ	0.4720 15	9.6×10^{-3}	E2
	0.5651 21	2.6×10^{-3}	E1
	0.5707 10	1×10^{-2}	M1
	0.6037 6	7.2×10^{-3}	M1 + E2
	0.7976 13	2.6×10^{-3}	M1 + E2
	0.8037	5×10^{-3}	E3
	1.0374 30		
	1.1687 22	4.5×10^{-4}	E1
	1.3687 40	9×10^{-4}	M1 + E2
	1.402		

H.H.Forster, J.S.Wiggins, Phys. Rev. 99, 660A (1955); verbal report.

β^-	0.086 15	0.645 10	sl
	0.335	~0.69	sl $\beta\gamma$

No ϵ_K (no Xe K x ray) scin, pc

γ		~0.25 ?		sl pe
		0.505 4	α_K	scin, sl ce, pe
	100+ {	0.559 4	0.0087	
		0.600 2	0.0047	
	70+	0.795 1	0.0015	
		1.039 12		sl ce
		1.163 12		
	1+	1.350 7		scin, sl ce

$(0.335\beta, \sim 0.69\beta)(E_\gamma > 1.10)$ sl, scin
$(0.335\beta, 0.65\beta, \sim 0.69\beta)(E_\gamma > 0.95)$
$(1.35\gamma)(\sim 0.60\gamma)$ No $(1.35\gamma)(0.80\gamma)$
$(\sim 0.58\,\gamma)(\sim 0.58\,\gamma, 0.80\,\gamma)$
Decay scheme proposed

G.Bertolini, M.Bettoni, E.Lazzarini, Nuovo Cim. 2, 273; 1, 746 (1955).

γ	4†	0.2004 15		sd ce, pc
	4†	0.2083 15		
	4†	0.4753 30		
	15†	0.5652 7		
	20†	0.5709 7		
	100†	0.6058 7	K/L = 6.3	
	2†	0.6618 20		
	100†	0.7970 6	K/L = 8.0	
	15†	0.8022 6		
	4†	1.0345 30		
	4†	1.168 3		
	4†	1.370 3		

J.Verhaeghe, J.Demuynck, Compt. rend. 239, 1374 (1954).

γ	3.5†	0.467 15	sl pe
		0.553 7	
	21†	0.571 7	
	100†	0.607 5	
	100†	0.794 3	
		1.027 15	
	4†	1.164 10	
	5.3†	1.368 5	
		1.401 15	

M.C.Joshi, B.V.Thosar, Phys. Rev. 96, 1022 (1954).

Cs^{134}
55 79
2.3^y
g.s.

γ sum peaks	1.175	Σscin
	1.400	
	1.972	

D.C.Lu, M.L.Wiedenbeck, Phys. Rev. 94,501(19 (1954).

No delayed $\beta\gamma$ ($\tau_\gamma < 5\times10^{-10s}$)

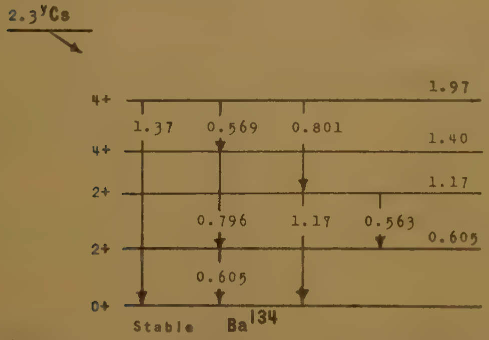
V.Z.Wintersteiger, Bull. Inst. Nuclear Sci., Boris Kidrich 4, 79 (1954).

γ (0.570) E2/M1 = 16, (0.605) E2, (0.797) E2, (1.368) E2 $\}$ $\gamma\gamma$ (θ)

($E_\gamma > 0.60$) ($E_\gamma > 0.60$) (θ) J = 4, 2, 0 scin
($E_\gamma > 1.20$) ($E_\gamma > 0.50$) (θ) J = 4, 2, 0
or J = 3, 2, 0
(0.57γ)(0.60γ)(θ) J = 4, 4, 2, 0

M.G.Stewart, R.P.Scharenberg, M.L.Wiedenbeck, Phys. Rev. 99, 691 (1955).

(0.796γ)(0.605γ)(θ) J = 4, 2, 0 scin
(1.37γ)(0.605γ)(θ) J = 4, 2, 0
(0.801γ)(1.17γ)(θ) J = 4, 2, 0
All 5 γ's are E2



A.E.Everett, M.J.Glaubman, Phys. Rev. 100, 955A (1955). (1955); verbal report.

Resonances Cs^{133}(n) E_n = 10 to 600 ev

E_o (ev)	Γ_n (10^{-3}ev)*	E_o (ev)	Γ_n (10^{-3}ev)*
22.6 *3*^{1}	6.6 *11*	204 *6*	57 *22*
47.8 *6*^{2}	19 *3*	224 *6*	49 *22*
83.1 *15*	9 *3*	240 *7*	480 *90*
94.8 *18*	19 *6*	301 *10*	190 *40*
128 *2*	112 *19*	370 *14*	160 *60*
143 *3*	9 *4*	407 *16*	570 *200*
149 *4*	45 *20*	443 *19*	290 *140*
182 *5*	3.4 *11*	530 *25*	800 *300*

Other resonances with $E_o > 250$ ev? chopper
* Based on $\overline{\Gamma}_\gamma = 0.110 \pm 0.030$ ev
Γ_γ(measured) = ^{1}0.120 ± 0.040, ^{2}0.140 ± 0.060 ev

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955); 95, 645A (1954).

Cs^{134}
55 79
3.15^h

J 8 M
μ + 1.10 *1*

L.S.Goodman, S.Wexler, Phys. Rev. 99, 192; 97, 242 (1955); 95, 570 (1954).

J 8 M
μ +1.10 *1*

D.A.Gilbert, V.W.Cohen, Phys. Rev. 97, 243 (1955); 95, 569 (1954).

β^- ~1% ~0.55 Cs^{133}(11-Mev d,p) sl
No 2.18 β^-

G.L.Keister, E.B.Lee, F.H.Schmidt, Phys. Rev. 97, 451 (1955).

Cs^{137}
55 82
27^y

τ 26.6^y *4* U(n,f) chem; 4π pc,ms

D.M.Wiles, R.H.Tomlinson, Phys. Rev. 99, 188 (1955).

τ 26^y *1* U(n,f) chem
From Cs^{133}/Cs^{137} ratio in fission products differing in age by 8^y ms

E.A.Melaika, M.J.Parker, J.A.Petruska, R.H. Tomlinson, quoted by Wiles et al., Phys. Rev. 99, 188 (1955).

Cs^{138}
55 83
33^m

17^{m}Xe^{138} source
scin

γ				
20+	0.128 *6*			
20+	0.460 *5*	100+	1.44 *2*	
3+	0.55 *1*	20+	2.24 *3*	
25+	0.98 *2*	10+	2.68 *3*	

S.Thulin, Arkiv Fysik 9, 137 (1955).

Cs^{139}
55 84
10^m

β^- 3.17 U(n,f) chem a

R.C.Fix, C.D.Coryell, MIT LNSE Progress Report, p 37, May (1954).

Ba
56

γ Ba(n,?γ) E_n = 3.2 scin

st	0.47		1.19
	0.60	st	1.41
	0.78		1.51
	1.06		2.1

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

$_{56}$Ba Resonances Ba(n,γ) E_n = 0.025 to 500 ev

E_o (ev)	$\sigma_o\Gamma^2$	mod cyc
25	8	
93	90	
380	550	

E.Meservey, Phys. Rev. 96, 1006 (1954); 86, 605A (1952).

Ba^{124}? τ ~12^m In$^{(115)}$(140-Mev N^{14},5n) chem
56 68

Possibly Ba^{127} but 6.3^{h}Cs^{127} not detected

M.I.Kalkstein, J.M.Hollander, Phys. Rev. 96, 730 (1954).

Ba^{126} τ 96.5^m *2.0* D 1.6^{m}Cs chem
56 70 In$^{(115)}$(140-Mev N^{14},3n)
96^m

γ 100† 0.225 *10* scin
33† 0.700 *30*
w 0.9 ?
x st K x ray
(0.225 γ) (0.70 γ) ?

M.I.Kalkstein, J.M.Hollander, Phys. Rev. 96, 730 (1954).

Ba^{127}? τ ~12^m In$^{(115)}$(140-Mev N^{14},2n) chem
56 71

6.3^{h}Cs^{127} not detected, activity probably Ba^{124}

M.I.Kalkstein, J.M.Hollander, Phys. Rev. 96, 730 (1954).

Ba^{128} ϵ Cs^{133}(106-Mev p,6n) chem
56 72
2.4^d
γ ~20% 0.270 α=0.35 scin, sl ce
K/L~2.5

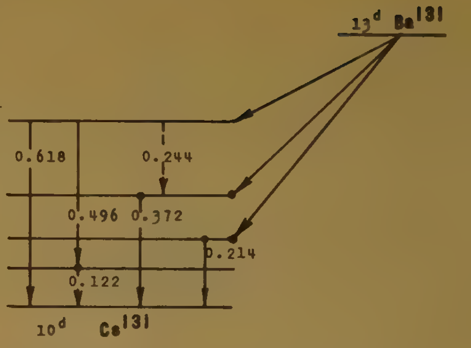
J.M.Hollander, M.I.Kalkstein, Phys. Rev. 98, 260A (1955).

Ba^{131} γ st 0.122 α~0.6 st 0.496 scin
56 75 st 0.214 w 0.618
13^d m 0.372 w 1.09*

No 0.048 γ, 0.065 γ, 0.108 γ
(K x ray)(0.122 γ, 0.214 γ, 0.372 γ) Σscin
(0.122 γ)(0.496 γ) No(0.214 γ)(0.372 γ)
No(0.122 γ)(0.214 γ, 0.372 γ)
*May be due to impurity

(Continued)

Ba^{131}
56 75
13^d



D.C.Lu, W.H.Kelly, M.L.Wiedenbeck, Phys. Rev. 97, 139 (1955).

Ba^{133} γ 0.072 *2* α_K = 2.4 x/γ scin $\gamma\gamma$
56 77 0.082
10^y
26† 0.290
74† 0.362
(0.29 γ)(0.072 γ, 0.082 γ) (0.36 γ)(0.082 γ)
K x rays are due to conversion only and
$\epsilon_L/\epsilon_K \geq 9$ assuming α_K = 1.6 for 0.082 γ

M.Langevin, Compt. rend. 240, 289 (1955).

(0.36 γ)(0.082 γ) delay = 6.0 ± 0.4 x 10^{-9s} scin

P.Lehmann, J. Miller, Compt. rend. 240, 1525 (1955).

Ba^{136} Resonances Ba^{135}(n) chopper
56 80
stable

E_o (ev)	Γ_n (10^{-3}ev)	Γ_γ (10^{-3}ev)
24.5	8.5	108
82.6	~180	~80
88.4		

A.Stolovy, J.A.Harvey, Phys. Rev. 99, 611A (1955); priv. comm.

Ba^{137} γ (0.662) d 33^{y}Cs; sd ce
56 81 K : L : LM : MN = 52 : 10 : 13 : 2.8
2.60^m

J.Verhaeghe, J.Demuynck, Compt. rend. 239, 1374 (1954).

Resonance Ba^{136}(n) chopper

E_o (ev)
106.9

A.Stolovy, J.A.Harvey, Phys. Rev. 99, 611A (1955); priv. comm.

Ba^{139} Ba$^{(138)}$(20-Mev d,p) chem
56 83 β(ce 0.163 γ) delay = 1.5 x 10^{-9s} scin
85^m

T.R.Gerholm, H.de Waard, Physica 21, 601 (1955).

Ba^{140} 56 84 13^d

γ 0.541 $\alpha_K = 6\times10^{-3}$ sl ce, pe
K/LM = 5.2 ± 0.5 E2

R.C.Rohr, R.D.Birkhoff, Phys. Rev. 98, 1266 (1955).

La^{138} 57 81 2×10^{11}y

J 5 I
μ +3.6848 *4*
$q(\mathrm{La}^{138})/q(\mathrm{La}^{139}) \cong 3.5 \pm 0.5^*$

P.B.Sogo, C.D.Jeffries, Phys. Rev. 99, 613A (1955); *verbal report.)

τ_{ϵ_K} $\sim 4\times10^{13y}$ Natural La chem; pc
$\epsilon_L/\epsilon_K \leq 0.5$
From presence of Ba K x rays and absence of L x rays

H.Selig, Thesis, Carnegie Inst. Tech. (1954).

La^{139} 57 82 stable

q +0.6 *2* S

K.Murakawa, Phys. Rev. 98, 1285 (1955)

q ~+0.3 *1* S

G.Löhrs, A.Steudel, Naturwiss. 42, 120 (1955). Z. Phys. 141, 486 (1955).

La^{140} 57 83 40.2^h

τ 40.31^h *6* 4π
$\mathrm{La}^{(139)}$(th n,γ)

L.Yaffe, H.G.Thode, W.F.Merritt, R.C.Hawkins, F.Brown, R.M.Bartholomew, Can. J. Chem. 32, 1017 (1954).

τ 40.5^h *6*

β^-	16%	0.42 *4*		s
	12%	0.86 *3*		
	20%	1.15 *3*		
	30%	1.36 *2*		
	14%	1.62 *2*		
	8%	2.20 *2*		
γ	1.3*	0.331 *2*	K : L : M = 100 : 14 : 6	
	0.46*	0.486 *3*	K : L : M = 32 : 8 : 4	
	0.10*	0.810 *3*		
	0.14*	1.60 *1*	K : L = 11 : 2	

*ce per 100 β^-

A.A.Bashilov, B.S.Dzhelepov, L.S.Chervinskaya, Izvest. Akad. Nauk Ser. Fiz. SSSR 18, 88 (1954).

γ d 13^dBa chem

		a	K/LM	
40+	0.328	0.035	7.4	sl ce, scin
6+	0.438			
50+	0.490	0.0083	7.4	
46+	0.815	0.0041	large	
100+	1.60	0.0008	large	
1+	2.50 *5*			scin pr
0.04+	3.00 *20*			

(Continued)

La^{140} 57 83 40.2^h

$(0.438\gamma)(0.490\gamma)$
$(0.815\gamma)(1.60\gamma)$
No $(0.815\gamma)(0.328\gamma, 0.438\gamma, 0.490\gamma)$
$(0.815\gamma)(1.60\gamma)(\theta)$ J = 3, 2, 0
E2/M1 ~ 0.02 for 0.815 γ
$(0.490\gamma)(1.60\gamma)(\theta)$ J = 4, 2, 0
$(0.328\gamma)(0.490\gamma, 1.60\gamma)(\theta)$ both compatible with spin assignments given above

H.H.Bolotin, C.H.Pruett, P.L.Roggenkamp, R.G.Wilkinson, Phys. Rev. 99, 62, 670A (1955).

γ 0.489 $\alpha_K \sim 5\times10^{-3}$ sl ce, pe
K/LM = 4.2 ± 1.4 E1, E2

R.C.Rohr, R.D.Birkhoff, Phys. Rev. 98, 1266 (1955).

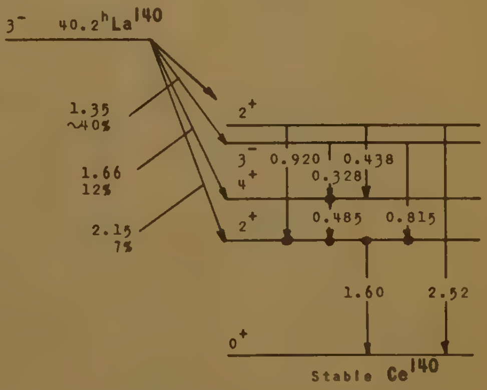
$(0.815\gamma)(1.60\gamma)(\theta)$ J = 3, 1, 0 or 3, 2, 0
$(0.485\gamma)(1.60\gamma)(\theta)$ J = 4, 2, 0 scin
$(0.328 + 0.485 + 0.815\gamma)(1.60\gamma)$([illegible]) consistent with $3^-, 4^+, 2^+, 0^+$ or with $3^+, 4^-, 2^-, 0^+$ for levels at 2.42, 2.09, 1.60 and 0 Mev

G.R.Bishop, J.P.Perez y Jorba, Phys. Rev. 98, 89 (1955).

γ	~25+	0.328	$\mathrm{La}^{(139)}$(slow n,γ); scin
	48+	0.486	
	27+	0.815	
	~11+	(0.920)	E2/M1 > 0.1%, < 1% $\gamma\gamma(\theta)$
	100+	1.597	
	4+	2.57 *15*	

No other γ with $E_\gamma > 0.05$
$(1.60\gamma)(0.328\gamma, 0.486\gamma, 0.815\gamma, 0.920\gamma)$
$(0.815\gamma, 0.920\gamma)(1.60\gamma$ only)
$(0.328\gamma)(0.486\gamma)$
$(0.920\gamma)(1.60\gamma)(\theta)$ J = 2, 2, 0

C.F.Coleman, Phil. Mag. 46, 1132 (1955).



Resonance La^{139}(n) chopper

E_o (ev)	Γ_n (10^{-3}ev)	Γ_γ (10^{-3}ev)
73.5	24	147

A.Stolovy, J.A.Harvey, Phys. Rev. 99, 611A (1955); priv. comm.

Ce
58

γ Ce(n, ?γ) E_n = 3.2 scin

0.48	1.50
0.90	2.5

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Ce^{139}
58 81
140^d

La$^{(139)}$ (11-Mev d,2n) chem

γ 0.1665 α_K = 0.20 sπ ce, scin

K : L : MN = 82 : 10 : 2.5 M1

No harder γ (< 0.1%) No other ce

No β^+

K x ray/0.166γ = 1.0 ± 0.2 scin

e_A/ce_K = 0.34 sπ

ϵ_K/ce_K = 4.4 ± 0.2 $(x\gamma/\gamma)/(xx/x)$

(K x ray) (0.166γ) delay < 10^{-8s} scin

$E_\epsilon \leq 0.15$ (to 0.166 level) from coincidence and single counting rates

C.H.Pruett, R.G.Wilkinson, Phys. Rev. 96, 1340 (1954); Phys. Rev. 95, 625A (1954).

Ce^{141}
58 83
32.8^d

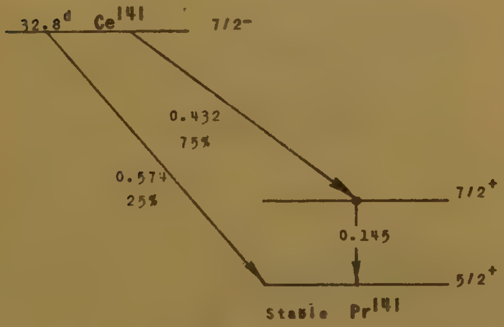
Ce$^{(140)}$ (pile n,γ) chem

β^-	75%	0.432	*2*	F-K linear	sl $\beta\gamma$
	25%	0.574	*3*	F-K linear	sl

γ 0.1449 *7* α_K = 0.22 K/L = 6.35 M1

No other γ's sl ce, pe; scin

(0.432 β)(0.145 γ) No (0.574 β)(0.145 γ)



J.T.Jones, Jr., E.N.Jensen, Phys. Rev. 97, 1031 (1955).

β(ce 0.145γ) delay = 1.9 x 10^{-9s} scin

H.de Waard, T.R.Gerholm, Physica 21, 599 (1955).

γ (0.145) M1

$\gamma(\theta, T)$ shows J = $7/2 \xrightarrow{\beta} 7/2 \xrightarrow{\gamma} 5/2$

E.Ambler, R.P.Hudson, G.M.Temmer, Phys. Rev. 97, 1212 (1955); 95, 625A (1954).

Ce^{141}
58 83
32.8^d

Resonances Ce^{140}(n) E_n = 0.5 to 60 kev
Li(p,n)

	E_o (kev)	
	2.8	*1.0*
	6.7	*1.0*
st	10	*1*
st	22	*1*
st	43	*1*

R.C.Block, H.W.Newson, Phys. Rev. 98, 1162A (1955); verbal report.

Ce^{143}
58 85
33^h

Ce^{142} (pile n,γ)

β^-	~0.3	(1.09) scin $\beta\gamma$
	~0.5	(1.38)
	(0.71)	

γ	0.0574 *2* α_K ~ 9		sl ce, scin
	0.232 *1*	0.668 *2*	
	0.294 *1*	0.724 *2*	
	0.351 *1*	0.861 *5*	
	0.493 *2*	1.10 *1**	
	0.565 *5**		*No ce

(1.38 β)(0.057 γ) delay < $1^{\mu s}$

(0.057 γ)(0.294 γ) (0.232 γ)(0.493 γ)

β to g.s. weak if present

D.W.Martin, J.M.Cork, S.B.Burson, Phys. Rev. 99, 670A (1955); verbal report.

Levels Ce^{142} (d,p) E_d = 15.1

g.s. Q = 2.86 *7* scin

0.90 *15*

N.S.Wall, Phys. Rev. 96, 664 (1954).

Resonances Ce^{142}(n) E_n = 0.5 to 125 kev
Li(p,n)

	E_o (kev)	
vst	1.6	*1.0*
st	3.2	
st	4.2	
w	9	
st	16	
st	26	
st	44	
	45	

R.C.Block, H.W.Newson, Phys. Rev. 98, 1162A (1955).

Ce^{144}
58 86
290^d

β^-	20%	0.160 *15*	U(n,f)chem; sd
	~5%	0.258 *15*	
	75%	0.327 *7*	

γ 0.0334 sπ ce

0.0408

0.0532

0.0590 K/L < 1 No L_2

0.0799

K : L_1 : L_3 = 345 : 100 : ~15

0.0950

0.1335

K : L_1 : L_2 : L_3 = 53 : 10 : 0 : ~1

0.1452

(Continued)

Ce^{144}
58 86
290^d

No 0.0468γ, 0.0603γ, 0.100γ, 0.231γ
(0.134γ)(0.033γ, 0.041γ)
(0.080γ)(0.041γ, 0.145γ?)

J.M.Cork, M.K.Brice, L.C.Schmid, Phys. Rev. 96, 1295 (1954).

γ 29† (0.081) Σ scin
100† (0.134)

W.E.Kreger, C.S.Cook, Phys. Rev. 96, 1276 (1954).

Pr^{135}
59 76
22^m

τ 22^m D 22^hCe
Ce^{136} (22-Mev p,2n) chem
Not by Ce^{136} (9.5-Mev p,n)
β^+ 2.5 *1* a,scin
γ 0.080 scin
0.22
0.30

T.H.Handley, E.L.Olson, Phys. Rev. 96, 1003 (1954).

Pr^{136}
59 77
70^m

τ 70^m Ce^{136} (9.5-Mev p,n) chem
β^+ 2.0 *1* a,scin
γ 0.17 scin
~0.8 ?
~1.1 ?

T.H.Handley, E.L.Olson, Phys. Rev. 96, 1003 (1954).

Pr^{137}
59 78

τ $>1^y$ or $<5^m$ scin
No 1.4^h activity Ce^{138} (22-Mev p) chem

T.H.Handley, E.L.Olson, Phys. Rev. 96, 1003 (1954).

Pr^{138}
59 79
2.0^h

τ 2.0 *1* Ce^{138} (9.5-Mev p,n) chem
β^+ 1.4 *1* a,scin
γ 0.30 ~1.4 ? scin
0.80 ~1.7 ?
1.05

T.H.Handley, E.L.Olson, Phys. Rev. 96, 1003 (1954).

Pr^{139}
59 80
4.5^h

Nd^{142} (18-Mev p,α) $Ce^{(140)}$ (fast p,2n)
τ 4.5^h p 140^dCe chem
β^+ 1.0 *1* a,scin
γ 0.17 in 140^dCe? scin
1.3
1.6

T.H.Handley, E.L.Olson, Phys. Rev. 96, 1003 (1954).

Pr^{140}
59 81
3.5^m

τ 3.4^m Pr^{141} (22-Mev p,pn) chem
$Ce^{(140)}$ (9.5-Mev p,n) chem

T.H.Handley, E.L.Olson, Phys. Rev. 96, 1003 (1954).

Pr^{141}
59 82
stable

Level $Pr^{(141)}$ (γ,γ)
γ (0.145) $\tau = 3.5 \times 10^{-9s}$
Ce^{141} source rotated to compensate for recoil

F.R.Metzger, Phys. Rev. 99, 613A (1955).

Pr^{142}
59 83
19.2^h

β^- 2.8% 0.70 *15* a $\beta\gamma$
97.2% 2.12 *10* a
γ 100† 1.61 *2* scin
No 0.134γ (<4†) No 0.329γ (<7†)
No 0.624γ (<7†) No γ with $E_\gamma > 1.61$

M.J.Sterk, R.H.Nussbaum, H.Cerfontain, Physica 21, 541 (1955).

γ 1.6 Pr^{141} (pile n,γ) scin
No other γ

B.Saraf, J.Varma, C.E.Mandeville, Phys. Rev. 98, 1206A (1955).

Levels Pr^{141} (d,p) $E_d = 15.1$
g.s. Q = 3.42 *30* scin
0.62 *10*

N.S.Wall, Phys. Rev. 96, 664 (1954).

Pr^{143}
59 84
13.8^d

No γ ($<10^{-3}$%) scin

B.Saraf, J.Varma, C.E.Mandeville, Phys. Rev. 98, 1206A (1955).

Pr^{144}
59 85
17.5^m

γ 12† (0.695) d 290^dCe; scin
2.3† (1.48)
5.9† (2.18)
†Photons per 100 Ce^{144} 0.134 photons

W.E.Kreger, C.S.Cook, Phys. Rev. 96, 855A, 1276 (1954).

β^- 1.5% 0.92 U(n,f) chem; sd
98.5% 3.12
γ 0.688 scin
1.49
2.18
No 0.0603γ ST ce

J.M.Cork, M.K.Brice, L.C.Schmid, Phys. Rev. 96, 1295 (1954).

Nd
60

Resonance $Nd(n)$ chopper

E_o (ev)
161

A.Stolovy, J.A.Harvey, Phys. Rev. 99, 611A (1955); priv. comm.

Nd^{143}
60 83
stable

μ −1.1 *1* Enriched Nd^{143}; S

K.Murakawa, Phys. Rev. 96, 1543 (1954).

Levels $Nd^{142}(d,p)$ $E_d = 15.1$
g.s. $Q = 3.79$ *8* scin
0.70 *10*

N.S.Wall, Phys. Rev. 96, 664 (1954).

$Nd^{143}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$
No γ with $E_\gamma < 0.50$ scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98 1198A (1955).

Nd^{144}
60 84
stable

$Nd^{(144)}(p,p'\gamma)$ $E_p = 3.34$
0.696 γ not observed ($\sigma < 0.6$ mb) scin

S.E.Simmons, D.M.Van Patter, K.F.Famularo, R.V.Stuart, Phys. Rev. 97, 89 (1955).

Resonances $Nd^{143}(n)$ chopper

E_o (ev)
56.3
132
191

A.Stolovy, J.A.Harvey, Phys. Rev. 99, 611A (1955); priv. comm.

Nd^{145}
60 85
stable

μ −0.69 *10* Enriched Nd^{145}; S

K.Murakawa, Phys. Rev. 96, 1543 (1954).

Level $Nd^{145}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$
γ 0.070 *2* scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Level $Nd^{(145)}(p,p'\gamma)$ $E_p \leq 3.34$
γ 0.071 *4* scin

S.E.Simmons, D.M.Van Patter, K.F.Famularo, R.V.Stuart, Phys. Rev. 97, 89 (1955).

Nd^{146}
60 86
stable

Level $Nd^{146}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$
γ 0.455 *10* scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Nd^{146}
60 86
stable

$Nd^{(146)}(p,p'\gamma)$ $E_p = 2.79$
0.455 γ not observed ($\sigma < 1$ mb) scin

B.E.Simmons, D.M.Van Patter, K.F.Famularo, R.V.Stuart, Phys. Rev. 97, 89 (1955).

Resonance $Nd^{(145)}(n)$ $E_n = 0.07$ to 20 ev

E_o (ev)	$\sigma_o\Gamma^2$	cryst
4.38 *4*	1–10	

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954).

Resonances $Nd^{145}(n)$ chopper

E_o (ev)	Γ_n (10^{-3}ev)	Γ_γ (10^{-3}ev)
4.32	0.90	55
43.2		
82.3 ?		
106		

A.Stolovy, J.A.Harvey, Phys. Rev. 99, 611A (1955); priv. comm.

Nd^{147}
60 87
11.6^d

$Nd^{(146)}$(pile n,γ) chem

γ	550+	0.092*	30+	0.410	scin
	w+	0.120	35+	0.440	
	15+	~0.165	250+	0.530	
	25+	0.280	w+	0.60	
	45+	~0.32	15+	0.690	

$(0.092\gamma)(0.120, 0.280, 0.32, 0.440, 0.60\gamma)$
$(0.280\gamma)(0.410\gamma)$
$(\sim 0.32\gamma)$(K x ray, $0.092, 0.120, 0.280\gamma)$
$^*\alpha_K \leq 1.8$ x/γ

H.S.Hans, B.Saraf, C.E.Mandeville, Phys. Rev. 97, 1267; 98, 1173A (1955).

γ (0.092)
(0.530) E2
$\gamma(\theta,T)$ shows $J = 9/2 \xrightarrow{\beta} 9/2 \xrightarrow{\gamma} 5/2$

E.Ambler, R.P.Hudson, G.M.Temmer, Phys. Rev. 97, 1212; 98, 230A (1955).

Nd^{148}
60 88
stable

Level $Nd^{148}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$
γ 0.300 *6* scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Level $Nd^{(148)}(p,p'\gamma)$ $E_p = 2.2$ to 3.5
γ 0.300 *3* $\tau = 2.6 \times 10^{-10} s^*$ scin
σ ($E_p = 2.25$) = 0.7 mb
*Estimated assuming E2 Coulomb excitation

B.E.Simmons, D.M.Van Patter, K.F.Famularo, R.V.Stuart, Phys. Rev. 97, 89 (1955).

Nd^{150}
60 90
$>10^{15y}$

τ_β $>10^{16y}$ DC

No β's with $0.006 < E_\beta < 0.3$ from 1.18g natural Nd ($2.1\ \text{mg/cm}^2$)

D.Dixon, A.McNair, Phil. Mag. 45, 1099 (1954).

Level $\text{Nd}^{150}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$

γ 0.128 *3* scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Level $\text{Nd}^{150}(p,p'\gamma)$ $E_p = 1.8$ to 3.3

γ 0.131 *2* $\tau = 7\times10^{-9}$s* scin

Graph of σ agrees with E2 Coulomb excitation

(p)(0.131γ)(θ) σ ($E_p = 2.25$) = 2.4 mb

*Estimated assuming E2 excitation

B.E.Simmons, D.M.Van Patter, K.F.Famularo, R.V.Stuart, Phys. Rev. 97, 89 (1955).

Pm^{147}
61 86
2.6^y

τ 2.52^y *8* ms

From 147/149 abundance ratios in fission products differing in age by 5.6^y

E.A.Melaika, M.J.Parker, J.A.Petruska, R.H.Tomlinson, Can. J. Chem. 33, 830 (1955).

Pm^{149}
61 88
50^h

Nd^{150}(9-Mev p,2n) chem

β^- 0.97 s

γ 0.285 scin

~1.0

V.K.Fischer, Phys. Rev. 96, 1549 (1954).

Pm^{150}
61 89
2.7^h

τ 2.7^h Nd^{150}(9-Mev p,n) chem

β^-	~80%	2.01 *5*			sd
	~20%	3.05 *5*			
γ	100†	0.34 *1*		1.24?	scin
		0.39?	4†	1.32 *5*	
	20†	0.43 *2*	0.8†	1.67 *5*	
	40†	0.82 *2*	0.4†	2.0 *1*	
		0.96?	0.8†	2.6 *1*	
	4†	1.17 *5*	0.4†	3.0 *1*	

($E_\beta = 2$) (0.34, 0.43, 0.82, 1.17γ's) scin
($E_\beta = 2$) (1.32, 1.67, <2.5 γ's)
($E_\beta = 3$) (0.39?, 0.82, 1.24?, 1.32 γ's)
(0.34 γ)(0.39?, 0.43, 0.82, 1.32, 1.67, <2.0γ's)
Decay scheme proposed

V.K.Fischer, Phys. Rev. 96, 1549; 95, 626A (1954).

Pm^{151}
61 90
28^h

$\text{Nd}^{(150)}$(pile n,$\gamma\beta$) chem

γ		0.064			scin $\gamma\gamma$
		0.100			
	70+	~0.167	40+	0.440	scin
	42+	0.230	18+	0.650	
	55+	0.275	26+	0.700	
	100+	0.335		1.50	

(K x ray)(0.230γ, 0.275γ, $E_\gamma > 0.53$)
(0.064γ)($0.23 < E_\gamma < 0.28$)
(0.100γ)(0.230γ, $E_\gamma > 0.53$)
(~0.167γ)(~0.167γ) No (0.100γ)(0.275γ)
($0.53 < E_\gamma < 0.65$)γ Decay scheme proposed

H.S.Hans, B.Saraf, C.E.Mandeville, Phys. Rev. 97, 1267; 98, 1173A (1955).

Sm
62

Resonances Sm(n) $E_n = 0.07$ to ~22 ev

cryst

E_0 (ev)		$\sigma_0\Gamma^2$*	Isotope**
0.0976	*5*	68	150
0.871	*5*	10-50	150
3.43	*2*	1-10	148
4.98	*5*	1-10	150
6.45	*10*	1-10	150 ?
8.2	*1*	>100	153
9.1	*2*	1-10	150 ?

E_0 (ev)		$\sigma_0\Gamma^2$*	Isotope**
12.0	*5*	1-10	
15.2	*5*	1-10	150 ?
17.2	*5*	1-10	150 ?
19.1	*5*	50-100	148
27.1	*5*	50-100	151

*For natural Sm **Enriched samples used

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954); 89, 904A (1953).

Sm^{147}
62 85
1.25×10^{11y}

$\text{Sm}^{147}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$

No γ with $E_\gamma < 0.50$ scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955).

Sm^{148}
62 86
stable

Level $\text{Sm}^{148}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$

γ 0.562 *12* scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Resonances Sm^{147}(n) $E_n = 0.07$ to ~22 ev

cryst

E_0 (ev)		$\sigma_0\Gamma^2$
3.43	*2*	10-50
19.1	*5*	>100

See also Sm

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954); 89, 904A (1953).

Sm^{149}
62 87
stable

$Sm^{149}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$
No γ with $E_\gamma < 0.50$ scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955).

Sm^{150}
62 88
stable

Level $Sm^{150}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$
γ 0.337 *7* scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Resonances $Sm^{149}(n)$ $E_n = 0.07$ to ~22 ev

E_o (ev)	$\sigma_o\Gamma^2$	cryst
0.0976 *5*	490	
0.871 *5*	>100	
4.98 *5*	10–50	
6.45 *10**	10–50	
9.1 *2**	10–50	
15.2 *5**	10–50	
17.2 *5**	10–50	

*Assignment uncertain See also Sm

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954); 89, 904A (1953).

Sm^{151}
62 89
~93^y

τ ~93^y ms
From 151/149 abundance ratios in fission products differing in age by 6.4^y

E.A.Melaika, M.J.Parker, J.A.Petruska, R.H. Tomlinson, Can. J. Chem. 33, 830 (1955).

Resonance $Sm^{150}(n)$ $E_n = 0.07$ to ~22 ev

E_o (ev)	$\sigma_o\Gamma^2$	cryst
21.1 *5*	>100	

See also Sm

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954); 89, 904A (1953).

Sm^{152}
62 90
stable

Level $Sm^{152}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$
γ 0.122 *2* scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report

Sm^{153}
62 91
47^h

β^{-**}	32%*	0.640 *15*		sl
	49%*	0.710 *15*		
	19%*	0.810 *10*		
γ	100†*	0.0690 *4*	$\alpha = 6$ K/L > 4.6	sl ce, scin
		0.1025 *5*	K/L > 6.1 $\tau = 4.0\times10^{-9}$ s	β(ce)
	0.033†*	0.1716	K/L = 4.5* $\tau = 1.4\times10^{-10}$ s	β(ce)
	w	0.520		

(0.64 β)(0.1025 γ) (0.71 β)(0.069 γ)
†ce per 100 β^-
**Spectrum analyzed only for $E_\beta > 0.35$

R.L.Graham, J.Walker, Phys. Rev. 94, 794A (1954); *priv. comm.

Sm^{153}
62 91
47^h

β^-	~20%	0.650 *15*		$Sm^{(152)}$(pile n,γ) sl $\beta\gamma$, sl
	~40%	0.720 *15*		
	~40%	0.820 *10*	K:L:M	
γ		0.069	> 13:1:0.3	sl ce, scin
	< 5†	0.084		
	100†	0.103	6.2:1:0.22	$\alpha_K = 1.2$ scin
		0.110 ?		
	≤ 1†	0.172		
	≤ 0.1†	0.545 *5*		

(0.103γ)(0.65β, 0.72β) (0.103γ)(0.545γ)

N.Marty, J. phys. radium 16, 458 (1955); 15, #12, 60s (1954); Compt. rend. 238, 2516 (1954).

Resonance $Sm^{152}(n)$ $E_n = 0.07$ to ~22 ev

E_o (ev)	$\sigma_o\Gamma^2$	cryst
8.2 *1*	> 100	

See also Sm

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954); 89, 904A (1953).

Sm^{154}
62 92
stable

Level $Sm^{154}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$
γ 0.082 *2* scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Eu
63

Resonances Eu(n) $E_n = 4$ to 50 ev

E_o (ev)	Γ_n (10^{-3} ev)*	E_o (ev)	Γ_n (10^{-3} ev)*
4.83 *4*	0.048 *8*	18.8 *2*	3.9 *8*
5.47 *5***	0.133 *18*	19.3 *2*	4.3 *8*
6.03 *8*	0.35 *5*	20.1 *2*	11.5 *12*
6.25 *8*	0.41 *7*	22.0 *3*	2.9 *7*
7.24 *10*	2.4 *5*	22.5 *3*	6.7 *13*
7.47 *10*	2.4 *5*	24.1 *3*	3.0 *8*
8.90 *9*	4.2 *4*	25.0 *3*	5.8 *12*
10.5 *1*	1.90 *13*	27.0 *4*	6.7 *14*
11.1 *2*	0.5 *2*	29.5 *4*	2.9 *15*
11.7 *1*	3.7 *3*	30.8 *4*	3.5 *18*
12.3 *2*	1.2 *2*	31.8 *4*	3.3 *17*
E_o (ev)	Γ_n (10^{-3} ev)*	E_o (ev)	Γ_n (10^{-3} ev)*
12.7 *1*	2.2 *4*	35.1 *5*	6 *2*
13.6 *2*	0.4 *2*	36.9 *5*	12 *4*
14.8 *2*	1.9 *3*	38.3 *6*	13 *4*
15.2 *2*	2.2 *3*	42.2 *7*	22 *7*
16.8 *2*	1.5 *2*	47.4 *8*	41 *12*
18.0 *2*	5.0 *5*	Others with $E_o > 8$ ev?	

*Based on $\overline{\Gamma}_\gamma = 0.090 \pm 0.020$ ev and an average isotopic abundance of 50% chopper
**May be due to Dy impurity
Resonance observed at 8.1 ev, assigned to Sm impurity

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Eu^{151}
63 88
stable

J 5/2 para
$\mu(Eu^{151})/\mu(Eu^{153}) = 2.24 \pm 0.03$

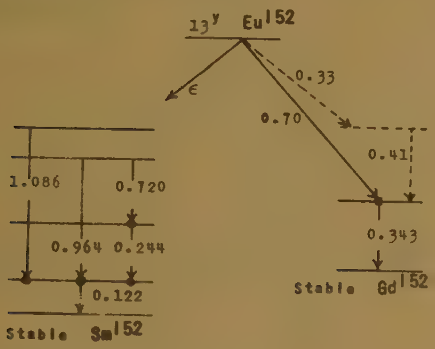
B.Bleaney, W.Low, Proc. Phys. Soc. 68A, 55 (1955).

Eu^{152}
63 89
13^{y}

β^- 0.33 *10?* $\mathrm{Eu}^{152,154}$ source; sl
0.70 *3* $\beta\gamma$

γ (0.122)* sl ce 0.41 ? scin
(0.244)* sl ce (0.720) scin
(0.343)* sl ce (0.964) scin
(1.086) scin

No 0.336 γ
(0.70 β) (ce_K 0.343 γ) sl
No β(ce_L 0.122 γ, ce_K 0.244 γ) sl
(ce 0.122 γ) (ce 0.244 γ, no ce 0.123 γ) sl
(x ray) (0.122 γ, 0.244 γ, 0.964 γ?) Σ scin
Sum peaks also at ~1.14? ~1.26 Σ scin
No (0.343 γ) (x ray, γ) Σ scin
*Assignment from ms results of Katz, Lee



13^{y} Eu^{152}
ε
0.33
0.70
0.41
1.086
0.720
0.964
0.244
0.122
0.343
Stable Sm^{152}
Stable Gd^{152}

R.E.Slattery, D.C.Lu, M.L.Wiedenbeck, Phys. Rev. 96, 465 (1954).

γ(0.122 γ) delay = 1.4×10^{-9}s

A.W.Sunyar, Phys. Rev. 98, 653 (1955).

Resonance $\mathrm{Eu}^{(151)}$(n) E_n = 0.001 to 0.01 ev
-0.0006 ev $\sigma_o = 8.4\times10^{4}$ cryst
Γ_γ = 0.067

W.Holt, Phys. Rev. 98, 1162A (1955).

Resonances $\mathrm{Eu}^{(151)}$(n) cryst

E_o(ev)	σ_o	Γ_γ(ev)	Γ(ev)
0.327	1,840	0.070±10	0.070
0.461	11,500	0.093±3	0.093
1.056	1,640	0.094±3	0.094

H.H.Landon, V.L.Sailor, Phys. Rev. 98, 225A, 1267 (1955).

Eu^{153}
63 90
stable

J 5/2 para
$\mu(\mathrm{Eu}^{151})/\mu(\mathrm{Eu}^{153}) = 2.24 \pm 0.03$

B.Bleaney, W.Low, Proc. Phys. Soc. 68A, 55 (1955).

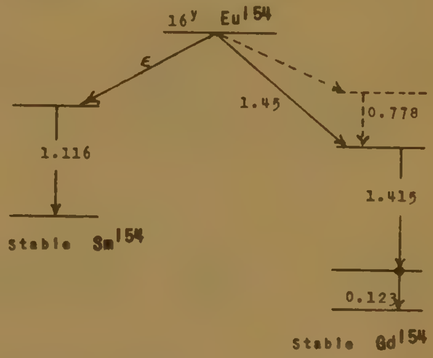
Eu^{154}
63 91
16^{y}

β^- 1.45 *5* $\mathrm{Eu}^{152,154}$source sl

γ (0.123)* (1.116)* scin
(0.778) ? 1.415**

No 0.336 γ
(1.415 γ) (x ray, 0.123 γ) Σ scin
No (0.123 γ) (x ray) Σ scin
No (0.778 γ) (x ray, γ) Σ scin
No (ce_L 0.123 γ)β sl

*Assignment from ms results of Katz, Lee
**Assignment from coincidences



16^{y} Eu^{154}
ε
1.45
0.778
1.116
1.415
0.123
Stable Sm^{154}
Stable Gd^{154}

R.E.Slattery, D.C.Lu, M.L.Wiedenbeck, Phys. Rev. 96, 465 (1954).

γ(0.123 γ) delay = 1.2×10^{-9}s

A.W.Sunyar, Phys. Rev. 98, 653 (1955).

Gd
64

Resonances Gd(n) E_n = 0.07 to ~ 35 ev

E_o(ev)		$\sigma_o\Gamma^2$	cryst
2.01	*1*	1-10	
2.57	*2*	10-50	
2.81	*3*	1-10	
6.33	*6*	10-50	
7.8	*1*	1-10	
11.9	*2*		
16.9	*4*		
21.1	*5*		
22.5	*6*		
30.8	*8*		
34.0	*10*		

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954).

Gd^{154}
64 90
stable

Level $\mathrm{Gd}^{154}(\alpha,\alpha'\gamma)$ E_α = 5.7
γ 0.123 *2* scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Gd^{155}
64 91
stable

J ≥5/2 s
μ −0.19 5 assuming J = 7/2

K.Murakawa, Phys. Rev. 96, 1543 (1954).

Level $Gd^{155}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$
γ 0.146 3 scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Gd^{156}
64 92
stable

Level $Gd^{156}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$
γ 0.089 2 scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Gd^{157}
64 93
stable

J ≥5/2 s
μ −0.33 6 assuming J = 7/2

K.Murakawa, Phys. Rev. 96, 1543 (1954).

Level $Gd^{157}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$
γ 0.131 3 scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Gd^{158}
64 94
stable

Level $Gd^{158}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$
γ 0.079 2 scin

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Gd^{159}
64 95
18.0^h

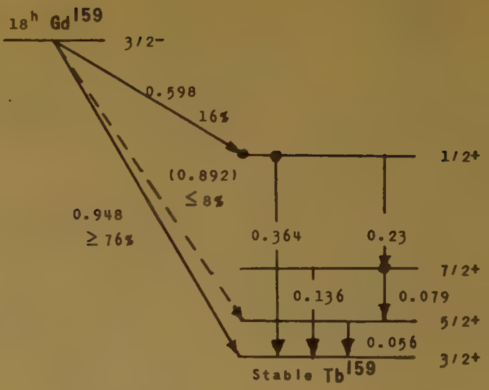
τ 18.0^h 2 $Gd^{(158)}$ (pile n,γ)
γ ~0.080 scin γγ
0.23
0.365 scin
(0.23γ)(0.08γ, K x ray)
No (0.36γ)(0.08γ, K x ray)

R.Barloutaud, R.Ballini, Compt. rend. 241, 389 (1955).

β^- 16% 0.598 8 $Gd^{(158)}$ (pile n,γ); s
≤ 8% (0.892)
≥ 76% 0.948 10
γ w 0.056 1 s ce, scin
0.364 $\alpha_K \sim 0.01$
(0.598β)(0.364γ) s
No (0.364γ)(0.056γ, K x ray)
No (ce 0.079γ) (< 4%) s

N.Marty, Compt. rend. 241, 385 (1955).

Gd^{159}
64 95
18.0^h



Tb^{151}
65 86

No 19^hTb α-activity found from Gd^{152} (14.0 or 22.4-Mev p) chem

T.H.Handley, W.S.Lyon, Phys. Rev. 99, 1415 (1955).

Tb^{152}
65 87

τ $< 10^m$ or $> 5^{y*}$ Gd^{152} (≤ 22.4-Mev p) chem
*Unless coincident with some other Tb period

T.H.Handley, W.S.Lyon, Phys. Rev. 99, 1415 (1955).

Tb^{154}
65 89
17^h

Gd^{155} (≥ 14-Mev p,2n) chem
τ 17.5^h Gd^{154} (9.5-Mev p,n) chem
β^+ ?, ε
Not produced by Gd^{152} (9.5-Mev p) chem

T.H.Handley, W.S.Lyon, Phys. Rev. 99, 1415 (1955).

Tb^{154}
65 89
$\sim 7.5^h$

Gd^{155} (≥ 14-Mev p,2n) chem
τ $\sim 7.5^h$ Gd^{154} (9.5-Mev p,n) chem
β^+ ?, ε
Not identical with 4.5^hTb
Not produced by Gd^{152} (9.5-Mev p) chem

T.H.Handley, W.S.Lyon, Phys. Rev. 99, 1415 (1955).

Tb^{155}
65 90

τ $< 10^m$ or $> 5^y$ Gd^{155} (9.5-Mev p) chem
190^dTb not found

T.H.Handley, W.S.Lyon, Phys. Rev. 99, 1415 (1955).

Tb^{156}
65 91
5.2^d

τ 5.2^d Gd^{156} (9.5-Mev p,n) chem
β^- 0.2 a
0.6
No β^+ (no $\gamma^{\pm}$) scin
ε Gd K, L x ray pc

γ		
0.10	0.76	scin
0.21	1.2	
0.26	1.4	
0.36	1.8	
0.54	2.0	

T.H.Handley, W.S.Lyon, Phys. Rev. 99, 1415 (1955).

Tb^{156}
$_{65}$ $_{91}$
5^h

τ 5.5^h Gd^{156}(9.5-Mev p,n) chem
β^- 0.14 a
γ ? (ce and Dy L x ray observed) pc,a
No hard γ a
5^h and 5.2^d Tb produced together by above reaction and by Gd^{157}(14-Mev p,2n) chem and Gd^{158}(22.4-Mev p,3n) chem

T.H.Handley, W.S.Lyon, Phys. Rev. 99, 1415 (1955).

Tb^{157}
$_{65}$ $_{92}$

τ $< 10^m$ or $> 25^y$ Gd^{157}($<$ 22.4-Mev p) chem
4.7^d Tb not found

T.H.Handley, W.S.Lyon, Phys. Rev. 99, 1415 (1955).

Tb^{158}
$_{65}$ $_{93}$
3.6^m

τ $< 10^m$ or $> 5^y$ Gd^{158}(9.5-Mev p) chem
See also M.L.Pool, L.L.Quill, Phys. Rev. 53, 437 (1938), who report $\tau = 3.6^m$

T.H.Handley, W.S.Lyon, Phys. Rev. 99, 1415 (1955)

Tb^{159}
$_{65}$ $_{94}$
stable

J 3/2 para
$|\mu|$ 1.5 *4*

J.M.Baker, B.Bleaney, Proc. Phys. Soc. 68A, 257 (1955).

γ $Tb^{159}(\alpha,\alpha'\gamma)$ $E_\alpha = 5.7$
0.079 *2* $\epsilon B(E2) = 0.19$ scin
0.136 *3* $= 0.04$
σ graphs show both γ's from 0.136 level

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Tb^{160}
$_{65}$ $_{95}$
73^d

τ 72.3^d *5*

β^- 19%	0.28 *4*	32%	0.557 *15*	s
19%	0.46 *2*	30%	0.851 *10*	

γ s ce,pe

0.064	0.297	
0.0862	0.391	0.962
0.093	0.411	0.976
0.156	0.466	1.034
0.181	0.569	1.110
0.196	0.679	1.173
0.214	0.762	1.196
0.234	0.856	1.250
0.274	0.876	1.266
0.282	0.915	1.447

(ce_L 0.086γ)(ce_K 0.196γ, ce_K 0.297γ) s ce
The above 29 most intense γ's (out of 70γ's found) fitted into 8 levels

V.Keshishian, H.W.Kruse, R.J.Klotz, C.M.Fowler, Phys. Rev. 96, 1050 (1954).

Tb^{160}
$_{65}$ $_{95}$
73^d

Tb^{159}(pile n,γ)
γ 0.0869 *3* $\alpha_K \leq 1.7$ cryst
No ϵ_K ($<$0.7%) (Dy K x ray $<$0.6%) 4π pc

γ					scin
	12†	0.087	34†	0.96	
	5†	0.195	25†	1.18	
	14†	0.290	11†	1.27	
	34†	0.88	16†	K x rays	

(1.18 or 1.27 γ)(0.087 γ and no other γ)
(0.087 γ)(0.88 γ) No (0.087 γ) (0.96 γ)
†Photons per 100 disintegrations

H.Jaffe, UCRL-2537 (1954).

Resonances Tb^{159}(n) $E_n = 0.07$ to 13 ev cryst

E_o (ev)	$\sigma_o\Gamma^2$
3.37 *3*	10-50
5.4 *2* ?	1-10
10.6 *3*	10-50
11.4 *2*	50-100

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954).

Resonances Tb^{159}(n) $E_n = 3$ to 200 ev

E_o (ev)	Γ_n (10^{-3}ev)*	E_o (ev)	Γ_n (10^{-3}ev)*
3.35 *3*	0.43 *5*	58.7 *8*	4.6 *11*
4.99 *5*	0.055 *8*	66.1 *11*	15 *4*
11.14 *10*	9.2 *18*	74.6 *13*	20 *5*
14.4 *2*	0.54 *11*	78.2 *14*	15 *4*
21.4 *2*	2.1 *2*	91.9 *18*	24 *6*
24.7 *3*	5.8 *7*	97.9 *19*	45 *11*
27.8 *3*	0.90 *12*	112.5 *20*	85 *25*
34.1 *4*	3.3 *7*	115 *2*	70 *30*
44.2 *6*	5.6 *8*	122 *3*	50 *30*
46.6 *6*	15 *3*	131 *3*	16 *8*
51.1 *7*	3.7 *7*	144 *3*	120 *30*
54.9 *7*	1.6 *6*	156 *4*	160 *40*

Other resonances with $E_o > 80$ ev? chopper
No resonance at 10.6 ± 0.3 ev
*Based on $\overline{\Gamma}_\gamma = 0.090 \pm 0.030$ ev

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Tb^{161}
$_{65}$ $_{96}$
6.8^d

τ 7.2^d *5* $Gd^{(160)}$(pile n,$\gamma\beta$)
β^- 0.55 *1* s
γ ~0.047 scin
~0.075
(0.55β)(0.075γ) β(0.047γ) s
(0.047γ)(0.075γ, K x ray)

R.Barloutaud, R.Ballini, Compt. rend. 241, 389 (1955).

γ 0.0488 *2* Tb^{159}(pile n); cryst

H.Jaffe, UCRL-2537 (1954).

$_{66}$Dy Resonances Dy(n) $E_n = 0.07$ to ~ 80 ev

E_o (ev)	$\sigma_o\Gamma^2$	cryst
1.72 *1*	10–50	
2.73 *2*	1–10	
3.70 *3*	1–10	
4.36 *5*	1–10	
5.49 *4*	> 100	
7.8 *2*		
9.9 *5*	< 1	
10.6 *15*	10–50	
13.5 *5*		
16.8 *3*		
19.7 *5*		
74 *15*	50–100	

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954); 91, 450A (1953).

Ho^{160}
$_{67}$ $_{93}$
5.0^h

τ 5.0^h d 29^hEr chem

γ 0.087 scin
0.194
0.65
0.73
0.89
0.97

Formerly assigned to Ho^{162} (see Phys. Rev. 94, 945, 1954).

W.E.Nervik, G.T.Seaborg, Phys. Rev. 97, 1092 (1955).

Ho^{164}
$_{67}$ $_{97}$
36.7^m

τ 36.7^m *5* Ho^{165}($\leq$ 22-Mev γ,n)

β^- 38† (0.90)
62† 0.99 *3* sd
No β^+ (< 0.08†) scin

γ 3.6† 0.0373 *5* α_L ~ 10 pc,sd ce
0.046 IT* ?
3.3† 0.0728 *5* $\alpha_K = 2.7$ E2 xx/xγ
$\tau = 1.4\times10^{-9s}$? xγ
3.5† 0.0905 *5* $\alpha_K = 1.9$ E2 βx/βγ
$\tau = 1.4\times10^{-9s}$ βγ

x 90† K x ray + 0.046γ
No Ho K x ray (< 27†) No Er K x ray (< 18†)
(β)(ce 0.091γ) No (β)(ce 0.046γ) sd
(β)(x ray)/(β)(0.091γ) = 1.8
(x ray)(0.037γ, 0.073γ),
No (0.037γ)(0.073γ)

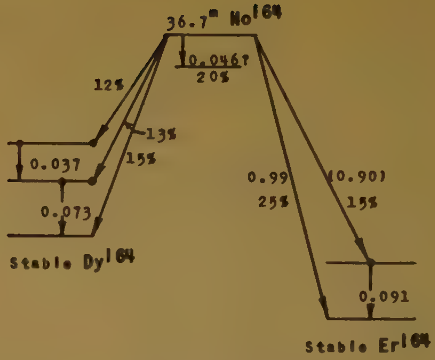
*Assignment to IT based on :

$\epsilon_K/\beta = 0.9 \pm 0.2$ from $x/\beta = 0.9 \pm 0.2$

(< 0.164-Mev pulses)/$\beta = 1.30 \pm 0.15$ Σ scin

(Continued)

Ho^{164}
$_{67}$ $_{97}$



H.N.Brown, R.A.Becker, Phys. Rev. 96, 1372 (1954); 95, 626A (1954).

Ho^{166}
$_{67}$ $_{99}$
27.3^h
g.s.

γ 0.080 scin
1.378 *7*
1.61 *2*
1.69 *2*

(0.080γ)(1.38γ)(θ) J = 0, 2, 0
(0.080γ)(1.61γ)(θ) J = 1, 2, 0
No (0.080γ)(1.69γ)

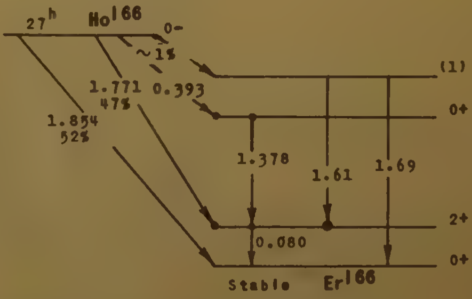
Attenuation of γγ(θ) coefficients shows quadrupole interaction

J.S.Fraser, J.C.D.Milton, Phys. Rev. 98, 1173A (1955); Proc. Roy. Soc. Canada 48, 12A (1954).

β^- 0.76% 0.393 sl βγ
47.6% 1.771 *7* ΔJ = 2, yes shape sl βγ
51.6% 1.854 *5* F-K plot linear sl

γ 0.0803 *2* $\alpha_K = 1.9$ E2 sl ce
K : L : MN = 10 : 25 : 7
0.76% 1.380 $\alpha_K = 1.7\times10^{-3}$ E2

No 0.184γ ($ce_K < 10^{-3}$%)
(1.77β)(0.080γ, ce_L 0.080γ) delay = 1.8×10^{-9s}
(1.77β)(0.080γ)(θ) J = 0, 2, 0 assuming same attenuation as for γγ(θ)



R.L.Graham, J.L.Wolfson, M.A.Clark, Phys. Rev. 98, 1173A (1955); verbal report.

Ho^{166}
67 99
$>30^y$

Ho^{165}(pile n,γ) chem

γ	1†	0.080	scin
	~1†	0.188 *5*	
	~1†	0.283 *10*	
	~1†	0.725 *20*	
	~1†	0.845 *20*	

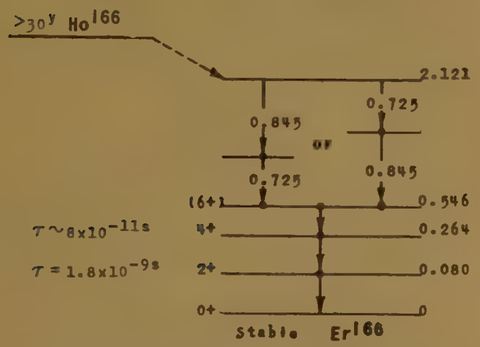
$(0.080\gamma)(0.188\gamma)(\theta)$ J = 4, 2, 0

All 5 γ's in cascade $\gamma\gamma$ scin

$(0.725\gamma, 0.845\gamma)$(most of the x rays)

τ (0.264 level) $\sim 8\times10^{-11}$s

No $\beta\gamma$ delay ($< 2\times10^{-9}$s)



J.C.D.Milton, J.S.Fraser, G.M.Milton, Phys. Rev. 98, 1173A (1955); verbal report.

γ	0.0803 *2*	sl ce
	0.1841 *10*	
	0.282 *4*	

$(0.080\gamma)(0.184\gamma)$ delay = $18.2\pm0.6\times10^{-10}$s

$(0.184\gamma)(0.282\gamma)$ delay = $8\pm5\times10^{-11}$s scin

g.s. and first 3 excited states form a rotational band (from energy spacing)

R.L.Graham, M.A.Clark, quoted by J.C.D.Milton et al., Phys. Rev. 98, 1173A (1955); verbal report.

Resonances Ho^{165}(n) E_n = 3 to 200 ev

E_o (ev)	Γ_n (10^{-3}ev)*	E_o (ev)	Γ_n (10^{-3}ev)*
3.92 *3*	2.5 *5*	66.3 *11*	38 *6*
12.8 *1*	13.1 *18*	70.0 *12*	1.1 *4*
18.2 *2*^{1}	0.92 *17*	73.1 *13*^{5}	35 *6*
21.3 *2*	0.73 *12*	83.4 *15*	1.2 *6*
35.9 *4*^{2}	7.5 *11*	87.2 *16*^{6}	96 *10*
37.9 *5*	0.36 *7*	96 *2*	125 *15*
40.3 *5*^{3}	21 *3*	104 *2*	65 *13*
+48.5 *6*^{4}	25 *4*	123 *3*	34 *16*
52.2 *7*	51 *6*	130 *3*	160 *25*
55.3 *8*	7 *3*	Others with $E_o > 90$ ev?	

*Based on $\overline{\Gamma}_\gamma = 0.090\pm0.020$ ev chopper

Γ_γ(measured) = $^1 0.180\pm0.090$, $^2 0.060\pm0.020$, $^3 0.060\pm0.030$, $^4 0.060\pm0.030$, $^5 0.140\pm0.070$, and $^6 0.260\pm0.130$ ev

+$\sigma_o \sim 7000$; $\sigma_o\Gamma^2 = 66$

Resonance at 8.1 ev assigned to Sm impurity

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955); V.E. Pilcher, R.S.Carter, A.Stolovy, Phys. Rev. 95, 645A (1954); verbal report.

Ho^{167}
67 100
3.0^h

τ		3.0^h	$Er^{(170)}$(15-Mev p,α) $Er^{(167)}$(fast n,p)	chem chem
β^-	~50%	0.28		a
	~50%	0.96		a, scin
γ	~18%	0.35		scin
	~ 6%	0.70		scin

No strong x ray scin

T.Handley, W.S.Lyon, E.L.Olson, Phys. Rev. 98, 688 (1955).

Er
68

Resonances Er(n) E_n = 0.07 to ~30 ev cryst

E_o (ev)	$\sigma_o\Gamma^2$
0.47 *1*	10-50
0.58 *1*	10-50
6.10 *6*	50-100
9.62 *9*	10-50
16.2 *2*	10-50
21.2 *3*	
27.5 *4*	

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954); 90, 362A (1953).

Er^{160}
68 92
29^h

τ 29^h Ta^{181}(340-Mev p) chem

No γ

p 5.0^hHo chem chem

W.E.Nervik, G.T.Seaborg, Phys. Rev. 97, 1092 (1955).

Er^{161}
68 93
3.1^h

τ 3.1^h Ta^{181}(340-Mev p) chem

β^+ 1.2 s

W.E.Nervik, G.T.Seaborg, Phys. Rev. 97, 1092 (1955).

Tm^{166}
69 97
7.7^h

γ	0.080	0.67	scin
	0.112	0.80	
	0.140	1.32	
	0.180		

γ's observed with 54^hYb source but assumed to belong to Tm^{166}

W.E.Nervik, G.T.Seaborg, Phys. Rev. 97, 1092 (1955).

Tm^{167}
69 98
9.6^d

τ 9.6^d Ta^{181}(340-Mev p) chem

γ	100†	0.049	9†	0.515	scin
	2†	0.115	18†	0.720	
	29†	0.202			

W.E.Nervik, G.T.Seaborg, Phys. Rev. 97, 1092 (1955).

Tm^{169}
69 100
stable

J 1/2 s

μ -0.20 *3*

Shell model predicts even parity but μ agrees with $p_{1/2}$ Schmidt limit

K.H.Lindenberger, A.Steudel, Naturwiss. 42, 41 (1955).

Tm^{170}
69 101
127^d

Tm^{169}(pile n,γ) chem
γ 2.6% 0.0841 *3* $\alpha_K = 1.6$ cryst
x 3.7% K x ray 4π pc
No ϵ_K (<0.2%) (Er K x ray <0.2%)

H.Jaffe, UCRL-2537 (1954).

γ 0.08426 *2* cryst

E.N.Hatch, F.Boehm, J.W.M.DuMond, priv. comm. October 1955.

Resonances Tm^{169}(n) E_n = 3 to 200 ev

E_o (ev)		Γ_n (10^{-3}ev)*		E_o (ev)		Γ_n (10^{-3}ev)*	
3.92	*3*	12	*4*	66.8	*11*	100	*15*
14.4	*1*^{1}	5.7	*8*	84.4	*15*	11	*3*
17.6	*2*^{2}	3.2	*4*	96	*2*	74	*11*
29.1	*3*	0.37	*13*	104	*2*	2.7	*14*
35.2	*4*^{3}	13	*2*	118	*2*	41	*12*
38.1	*5*	0.61	*12*	128	*3*	10	*5*
45.6	*6*	6.4	*13*	139	*3*	45	*30*
51.6	*7*	7.7	*16*	158	*4*	160	*40*
59.8	*8*	24	*5*	Others with E_γ > 75 ev			

*Based on g = 1/2 and $\overline{\Gamma}_\gamma = 0.07 \pm 0.02$ ev
Γ_γ(measured) = ^{1}0.075 ± 0.020, ^{2}0.083 ± 0.016, and ^{3}0.110 ± 0.040 ev chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Tm^{171}
69 102
680^d

β^- 0.103 *2* $Er^{(170)}$(n,$\gamma\beta$) sl
No γ scin

A.Bisi, S.Terrani, L.Zappa, Nuovo Cim. 2, 172 (1955).

Yb
70

Resonances Yb(n) E_n = 0.07 to 20 ev cryst

E_o (ev)		$\sigma_o\Gamma^2$**
0.597	*1**	1.28 ± 0.10
4.551	*3*	< 1
8.09	*8*	1-10
13.30	*14*	1-10
18.2	*2*	1-10

*Assigned to A = 169 **For natural Yb

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954); 89, 904A (1953).

Yb^{166}
70 96
54^h

τ 53.8^h Ta^{181}(340-Mev p) chem
D 7.7^hTm chem
γ 0.112* scin
0.140*
*Possibly in 7.7^hTm

W.E.Nervik, G.T.Seaborg, Phys. Rev. 97, 1092 (1955).

$Yb^{167?}$
70 97
74^m

τ 74^m Ta^{181}(340-Mev p) chem
β^+ 2.4 *2* s

W.E.Nervik, G.T.Seaborg, Phys. Rev. 97, 1092 (1955).

Yb^{169}
70 99
31.8^d

Resonance $Yb^{(168)}$(n) E_n = 0.07 to 20 ev cryst

E_o (ev)		$\sigma_o\Gamma^2$
0.597	*1*	995 ± 90

See also Yb

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954); 89, 904A (1953)

Yb^{173}
70 103
stable

J 5/2 S

K.Krebs, H.Nelkowski, Ann. Physik 15, 124 (1955).

Yb^{175}
70 105
4.2^d

β^- 10% 0.072 *3* sd
3% (0.350)
87% 0.463 *3*
γ 25+ 0.1130 *3* K/LM ~2.5 scin; sd ce
$\alpha_K = 2.2$ E2/M1 = 0.3
50+ 0.281 *1* K/L > 4 M2/E1 ~0.04*
100+ 0.3951 *3* K/L ~5.9 M2/E1 = 0.26*
L/MN ~4.3
*(ce_K 0.281 γ)/(ce_K 0.395 γ) = 0.30
(0.072 β)(0.281 γ, 0.395 γ) delay < 6×10^{-8}s
(0.350 β)(0.113 γ) delay < 2×10^{-9}s

H. de Waard, Phil. Mag. 46, 445 (1955).

$Yb^{(174)}$(th n,γ)
β^- 7% 0.072 scin $\beta\gamma$, sl
3% 0.355
90% 0.468
γ 0.1136 M1 + E2 sl ce, scin
0.1376
0.144
0.251
0.2824 E1 + M2
0.3960 M2 + (E1?)
(0.072 β)(0.396 γ) (0.355 β)(0.113 γ)
(0.113 γ)(0.282 γ) (0.144 γ)(0.251 γ)

J.P.Mize, M.E.Bunker, J.W.Starner, Phys. Rev. 99, 671A (1955); verbal report.

γ 0.113 Pu^{239}(n, f) chem; scin
W 0.143
0.283
~0.40
(0.283 γ)(0.113 γ, K x ray)
(0.113 γ)(K x ray)

J.R.Grover, UCRL-2841 (1954).

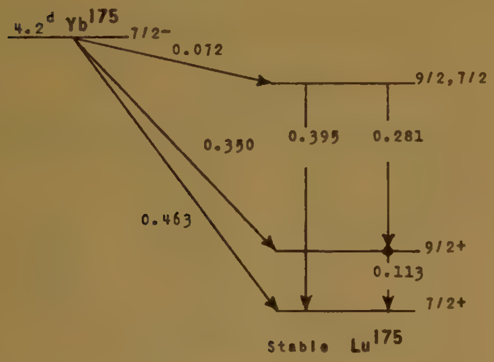
γ 0.113 *1* $\alpha_K = 2.4$ γx/$\gamma\gamma$; scin
58+ 0.282
100+ 0.396
(0.282 γ)(0.113 γ, K x ray)
No (0.396 γ)γ

N.Marty, Compt. rend. 240, 963 (1955).

Yb^{175}
70 105
4.2^{d}

$(0.281\gamma)(0.113\gamma)(\theta)$ J = 9/2, 9/2, 7/2
with quadrupole/dipole = 0.02* for 0.281 γ
or J = 7/2, 9/2, 7/2
with quadrupole/dipole = 0.14* for 0.281
*Using E2/M1 = 0.3 for 0.113 γ (See deWaard above)

L.Åkerlind, B.Hartmann, T.Wiedling, Phil. Mag. 46, 448 (1955).



Yb^{177}
70 107
1.8^{h}

β^-	9%	(1.15)		sl
	3%	(1.18)		
	88%	1.30 *5*		
γ	18+	0.119 *1*	K/LM ~ 3	scin, sl ce
	100+	0.146 *1*	K/LM ~ 3.5	
			α_K = 0.63	M2/E1 = 0.11

$\beta(0.146\gamma)$ delay = 0.122$^{\mu s}$

H. de Waard, Phil. Mag. 46, 445 (1955).

Lu
71

Resonances Lu(n) E_n = 4 to 150 ev

E_o (ev)	Γ_n (10^{-3} ev)*	E_o (ev)	Γ_n (10^{-3} ev)*
4.39 *3*	0.012 *6*	37.1 *4*^{4}	6.4 *9*
4.78 *3*	0.28 *3*	41.5 *5*^{5}	24 *3*
5.22 *4*	1.2 *2*	46.2 *6*	0.39 *15*
6.17 *5*	0.062 *12*	50.7 *7*	38 *4*
9.8 *1*	0.044 *12*	54.3 *7*	0.8 *3*
11.3 *1*^{1}	3.2 *5*	57.5 *10*	3.7 *7*
14.1 *1*	18 *3*	57.5 *10*	3.7 *7*
15.5 *2*	1.40 *15*	63.0 *10*	1.3 *6*
20.0 *2*	0.08 *2*	71.0 *12*	10 *3*
20.7 *2*^{2}	2.3 *3*	86.0 *15*	4 *2*
22.0 *2*	0.07 *2*	89.4 *16*	4 *2*
23.7 *2*^{3}	4.9 *7*	98.9 *18*	93 *11*
24.8 *3*	0.17 *6*	104 *2*	36 *11*
27.3 *3*	0.27 *8*	110 *2*	39 *10*
28.2 *3*	1.4 *3*	119 *3*	83 *11*
30.4 *3*	9.2 *17*	132 *3*	150 *15*
31.2 *3*	2.3 *6*	Others with E_o > 45 ev?	

*Based on $\bar{\Gamma}_\gamma$ = 0.070 ± 0.020 ev; Γ_n is the atomic value chopper

Γ_γ (measured) = ^{1}0.040 ± 0.020, ^{2}0.160 ± 0.050, ^{3}0.070 ± 0.020, ^{4}0.090 ± 0.030, ^{5}0.080 ± 0.030

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Lu
71

Resonances Lu(n) E_n = 0.07 to ~21 ev
cryst

E_o (ev)	$\sigma_o\Gamma^{2}$*	Isotope
0.142 *1*	1.4 ± 0.3	177
1.57 *1*	< 1	177
2.62 *2*	1–10	177
4.80 *4*	1–10	177 ?
5.30 *5*	10–50	176
11.4 *2*	10–50	176
14.4 *3*		176
20.6 *5*		176 ?

*For natural Lu

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954); 92, 656 (1953); 90, 362A (1953).

Lu^{175}
71 104
stable

Levels Lu$^{(175)}$(p,p'γ) E_p = 2.6
γ 0.112 *3* scin
0.240 *7*

C.McClelland, H.Mark, C.Goodman, Phys. Rev. 97, 1191 (1955); 98, 249A (1955).

Q +5.7 *3* S
Recalculated from data of H. Gollnow, Z. Phys. 103, 443 (1936)

T.Kamei, Phys. Rev. 99, 789 (1955).

Lu^{176}
71 105
2.4×10^{10y}

Resonances Lu$^{(175)}$(n) E_n = 0.07 to ~21 ev
cryst

E_o (ev)	$\sigma_o\Gamma^{2}$
5.30 *5*	10–50
11.4 *2*	10–50
14.4 *3*	
20.6* *5*	

*Assignment uncertain

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954); 92, 656 (1953); 90, 362A (1953).

Lu^{177}
71 106
6.8^{d}

Resonances Lu$^{(176)}$(n) E_n = 0.07 to ~21 ev
cryst

E_o (ev)	$\sigma_o\Gamma^{2}$
0.142 *1*	54 ± 12
1.57 *1*	10–50
2.62 *2*	> 100
4.80* *4*	> 100

*Assignment uncertain

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 96, 1014 (1954); 92, 656 (1953); 90, 362A (1953).

$(0.113\gamma)(0.208\gamma)(\theta)$ $\eta(\pi)$ = −0.18

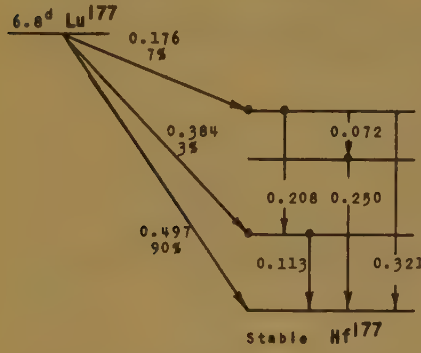
B.Hartmann, T.Wiedling, Phil. Mag. 46, 1139 (1955).

Lu^{177}
71 106
6.8^d

$\mathrm{Lu}^{(176)}$ (pile n,γ)

β^-	7%	0.176		sl $\beta\gamma$
	3%	0.384		sl $\beta\gamma$
	90%	0.497 *2*		sl
γ	2†	0.07164 *2*	$\alpha \sim 0$	E1 cryst
	100†	0.11297 *2*	$\alpha_K = 0.75$	E2
		$\alpha_{L_1} = 0.12$; $\alpha_{L_2} = 0.70$; $\alpha_{L_3} = 0.58$		
	220†	0.20836 *2*	$\alpha_K = 0.044$	
			$\alpha_{L_1} = 0.007$	E1
	3†	0.2500 *5*	$\alpha_K = 0.3$ $\alpha_{L_1} = 0.1$	
	3†	0.3213 *1*	$\alpha_K = 0.2$	

(0.072γ)(0.250γ)



P.Marmier, F.Boehm, Phys. Rev. 97, 103(1955).

Hf
72

Levels Hf(p,p$'\gamma$) $E_p = 4.0$; γ scin
~0.090 $\tau = 1.1\times10^{-9}$s* (α = 6.1)
~0.112 ϵB(E2) = 0.59**
0.248**

*Average for even isotopes
**Average for odd isotopes

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112 (1955).

Hf^{175}
72 103
70^d

γ	0.0893	sl ce, scin
	0.1136	
	0.2293	
	0.3186	
	0.3429	
	0.4322	

(0.089γ)(0.343γ)

J.P.Mize, M.E.Bunker, J.W.Starner, Phys. Rev. 99, 671A (1955); verbal report.

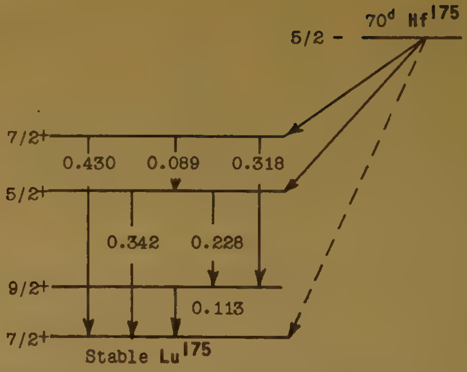
Hf^{174} (pile n,γ) sl ce

γ	121*	0.0891	K/L≈ 6.0	L/M = 3.5
		0.1134		
	2.6*	0.228	K/LM = 2.0	
	1*	0.318		
	102*	0.3423	K/LM = 4.9	
	7*	0.430		

Relative photon intensities sl pe
0.089γ: 0.113γ: 0.342γ => 28 :> 5: 900
No 1.5γ
*Relative ce intensity

(Continued)

Hf^{175}
72 103
70^d



A.O.Buford, J.F.Perkins, S.K.Haynes, Phys. Rev. 99, 3 (1955); 95, 303A (1954).

Resonance Hf^{174}(n) E_n = 4 to 150 ev

E_0 (ev)	Γ_n (10^{-3}ev)*
30.5 *4*	49 *6*

Possibly additional weak resonances chopper
*Based on $\overline{\Gamma}_\gamma = 0.060 \pm 0.020$ ev

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Hf^{176}
72 104
stable

Level **Hf^{176}($\alpha,\alpha'\gamma$)** **E_α = 5.7**
γ **0.087 *3*** **scin**

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Level Hf^{176}(p,p$'\gamma$) E_p = 1.5
γ 0.087 *3* scin

C.McClelland, H.Mark, C.Goodman, Phys. Rev. 97, 1191 (1955); 98, 249A (1955).

Hf^{177}
72 105
stable

Levels **Hf^{177}($\alpha,\alpha'\gamma$)** **E_α = 5.7**
γ **0.113 *2*** **scin**
0.250 *5*

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Levels **Hf^{177}(p,p$'\gamma$)** **E_p = 2.6**
γ **0.112 *3*** **scin**
0.235 *7*

C.McClelland, H.Mark, C.Goodman, Phys. Rev. 97, 1191 (1955); 98, 249A (1955).

$\mathrm{Hf}^{(176)}$(n) E_n = 4 to 150 ev
No strong resonances chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Hf^{178}
72 106
stable

Level Hf^{178}($\alpha,\alpha'\gamma$) $E_\alpha = 5.7$
γ (0.090) scin

H.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Level Hf^{178}($p,p'\gamma$) $E_p = 1.5$
γ 0.091 *3* scin

C.McClelland, H.Mark, C.Goodman, Phys. Rev. 97, 1191 (1955); 98, 249A (1955).

Resonances Hf^{177}(n) $E_n = 4$ to 150 ev

E_o (ev)	Γ_n (10^{-3}ev)*	E_o (ev)	Γ_n (10^{-3}ev)*
5.9 *1*	5.1 *15*	49.4 *7*	55 *5*
6.6 *1*	11 *3*	55.6 *7*	18 *4*
8.8 *1*	8 *3*	57.2 *8*	13 *3*
13.1 *2*	0.67 *8*	60.3 *10*	2.8 *8*
14.1 *2*	2.2 *3*	64.4 *10*	66 *8*
22.2 *2*	2.7 *3*	67.7 *11*	36 *4*
23.5 *2*	1.6 *4*	72.3 *12*	14 *4*
25.9 *3*	0.41 *8*	77.2 *13*	16 *3*
27.2 *3*	1.80 *18*	84.3 *15*	3.4 *9*
33.2 *4*	1.2 *2*	86.2 *16*	22 *4*
37.2 *5*	23 *5*	93.6 *18*	6.4 *13*
43.6 *6*	4.3 *5*	98.5 *19*	13 *3*
45.7 *6*	4.6 *6*	103 *2*	20 *7*
46.8 *6*	4.9 *8*	105 *2*	32 *10*

Additional resonances with $E_o > 34$ ev?
*Based on $\overline{\Gamma}_\gamma = 0.056 \pm 0.015$ ev chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Hf^{179}
72 107
stable

Levels Hf^{179}($\alpha,\alpha'\gamma$) $E_\alpha = 5.7$
γ 0.119 *2* scin
0.260 *5*

H.P.Heydenburg, G.M.Temmer, Phys. Rev. 98, 1198A (1955); verbal report.

Levels Hf^{179}($p,p'\gamma$) $E_p = 2.6$
γ 0.122 *4* scin
0.250 *15*

C.McClelland, H.Mark, C.Goodman, Phys. Rev. 97, 1191 (1955); 98, 249A (1955).

Resonance Hf^{178}(n) $E_n = 4$ to 150 ev

E_o (ev)	Γ_n (10^{-3}ev)*
7.80 *10*	49 *3*

*Based on $\overline{\Gamma}_\gamma = 0.060 \pm 0.020$ ev chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Hf^{180}
72 108
stable

Level Hf^{180}($\alpha,\alpha'\gamma$) $E_\alpha = 5.7$
γ (0.093) scin

H.P.Heydenburg, G.M.Temmer, Phys. Rev. 98 1198A (1955); verbal report.

Hf^{180}
72 108
stable

Level Hf^{180}($p,p'\gamma$) $E_p = 1.5$
γ 0.092 *3* scin

C.McClelland, H.Mark, C.Goodman, Phys. Rev. 97, 1191 (1955); 98, 249A (1955).

Resonances Hf^{179}(n) $E_n = 4$ to 150 ev

E_o (ev)	Γ_n (10^{-3}ev)*	E_o (ev)	Γ_n (10^{-3}ev)*
5.69 *5*	4.2 *13*	53.5 *7*	0.56 *12*
17.8 *2*	2.0 *2*	55.4 *8*	3.7 *5*
24.0 *2*	5.3 *14*	61.2 *10*	0.63 *16*
27.0 *3*	1.25 *19*	63.0 *10*	0.73 *15*
31.5 *4*	6.0 *12*	70.1 *12*	8.1 *15*
36.8 *5*	17 *5*	78.2 *13*	3.1 *5*
40.6 *5*	20 *4*	80.7 *14*	1.7 *4*
42.8 *6*	11.9 *17*	84.3 *15*	5.7 *12*
44.7 *6*	0.41 *12*	86.7 *16*	3.9 *7*
48.1 *7*	0.8 *2*	93.6 *18*	32 *8*
51.1 *7*	0.9 *2*	103 *2*	99 *15*
51.7 *7*	0.51 *10*	106 *2*	3.8 *11*
52.4 *7*	0.53 *10*	110 *2*	12 *3*

Additional resonances with $E_o > 65$ ev?
*Based on $\overline{\Gamma}_\gamma = 0.060 \pm 0.020$ ev chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Hf^{181}
72 109
46^d

γ		E2	M1	
	(0.132)	100%		$\gamma\gamma(\theta)$
	(0.135)	20%	80%	
	(0.345)	100%		
	(0.480)	97%	3%	

(0.132 γ)(0.480 γ)(θ) J = 1/2, 5/2, 7/2
(0.345 γ)(0.135 γ)(θ) J = 5/2, 9/2, 7/2

H.Paul, Purdue University, Dissertation Abstr. 15, 855 (1955).

(0.132 γ)(0.480 γ) delay = 1.0×10^{-8}s scin

L.Dick, R.Foucher, M.Perrin, H.Vartapetian, Compt. rend. 240, 1335 (1955).

Resonance Hf^{180}(n) $E_n = 4$ to 150 ev

E_o (ev)	Γ_n (10^{-3}ev)*
73.9 *12*	50 *6*

*Based on $\overline{\Gamma}_\gamma = 0.060 \pm 0.020$ ev chopper

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10 (1955).

Ta
73

Abundances ms

Ta^{180}	0.0123%
Ta^{181}	99.988%

No Ta^{177}, Ta^{178}, Ta^{179} (< 0.0003%)
No Ta^{182}, Ta^{183} (< 0.0002%)

F.A.White, T.L.Collins, Jr., F.M.Rourke, Phys. Rev. 97, 566 (1955).

Ta^{180}
73 107
8.15^h

(K x ray)(0.093γ) delay = 1.4×10^{-9s}

A.W.Sunyar, Phys. Rev. 98, 653 (1955); 95, 626A (1954).

Ta^{181}
73 108
stable

Q +4.3 *4* S

T.Kamei, Phys. Rev. 99, 789 (1955).

Levels $Ta^{181}(p,p'\gamma)$ E_p = 1.4 to 5.0

0.137 level

γ (0.137) $\epsilon B(E2)$ = 2.5 scin

0.303 level

γ (0.166) E2/M1 = 0.25 p,$\gamma(\theta)$
(0.303) $\epsilon B(E2)$ = 0.62 scin

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112 (1955).

Level $Ta^{181}(\alpha,\alpha'\gamma)$ E_α = 3.65
γ 0.137 K/L ~ 6 sπ ce
93% M1, 7% E2

E.M.Bernstein, H.W.Lewis, Phys. Rev. 99, 617A (1955); verbal report.

Levels $Ta^{181}(p,p'\gamma)$
γ 0.138 *4* scin
0.300 *9*

C.McClelland, H.Mark, C.Goodman, Phys. Rev. 97, 1191 (1955); 98, 249A (1955).

Level $Ta^{181}(\gamma,\gamma')$
(0.61) τ = $20.5^{\mu s}$ *4*

T.F.Godlove, J.G.Carver, Phys. Rev. 99, 1634A (1955).

γ $Ta^{181}(n,n'\gamma)$ E_n = 3.2 scin

1.26†	0.46
0.93†	1.4

†σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Resonance $Ta^{(180)}(n)$ E_n = 0.35 to 0.58 ev
0.433 ev σ_o = 12,900* cryst
Γ = 0.030

*Using 0.0123% for abundance

J.E.Evans, E.G.Jokl, R.R.Smith, Phys. Rev. 97, 565 (1955).

Ta^{182}
73 109
111^d

τ 115.5^d

γ

0.0657 *2*		sd ce,pe
0.0677 *2*		0.9295 *10*
0.0847 *3*		0.9594 *18*
0.1001 *3*		1.0015 *18*
0.1098 *5*		1.0459 *10*
0.1135 *2*	100*	1.1220 *10*
0.1162 *5*		1.1591 *10*
0.1516 *10*	80*	1.1893 *18*
0.1794 *10*	80*	1.2220 *10*
0.1976 *10*	9*	1.2303 *12*
0.2221 *5*	5*	1.2575 *20*
0.2290 *5*	2*	1.2745 *10*
0.2638 *10*	10*	1.2894 *20*
0.2962 *10*		1.3310 *20*
0.3295 *10*		1.3725 *20*
0.3352 *8*		1.4536 *11*
0.8934 *13*		1.6085 *15*

*Relative intensity ce_K

C.M.Fowler, H.W.Kruse, V.Keshishian, R.J.Klotz, G.P.Mellor, Phys. Rev. 94, 1082 (1954); priv. comm.

β^- 0.51 *1* Ta^{181}(pile n,γ); sl

Evidence for at least 2 lower energy β's
sl ce, cryst

γ			α_K	α_{L_1}	α_{L_2}	α_{L_3}
(E1)	w	0.03336				
(E1)	w	0.04271				
M1	8†	0.06571*		2.8	0.4	0.23
E1	85†	0.06774*		0.17	0.07	0.07
M1	5†	0.08467*		1.8	0.6	0.5
E2	40†	0.10009*	1.5	0.13	1.45	1.35
M1	8†	0.11366	1.7	0.4	0.07	
	1.7†	0.11640				
E1	35†	0.15241	0.07			
(E1)	12†	0.15637	small			
	16†	0.17936	0.41	0.17		0.05
E2	7.5†	0.19831	0.24		0.11	0.07
E1	35†	0.22205	0.06	0.01		
E2	20†	0.22927	0.16		0.05	0.03
E2	22†	0.26409	0.11		0.04	0.02
(E3)		0.927				
(E3)		0.960		K/L		
(M1 + E2)		1.003		7.0		
M1 + E2	100†	1.122	0.005	6.7		
(M2)	6.5†	1.155	0.004			
M2 + E3	45†	1.189	0.006	6.5		
E2	95†	1.222	0.003	6.0		
E2	50†	1.231	0.003			
(M2)		1.289		6.6		
(E3)		1.375				
		1.437				
(M2 + E3)		1.454				

*M and N conversion data given
Decay scheme proposed
α's based on $\alpha_K(Ta^{183}$ 0.24605$\gamma)$ = 0.38

J.J.Murray, F.Boehm, P.Marmier, J.W.M.DuMond, Phys. Rev. 97, 1007 (1955); 95, 864 (1954).

Ta^{182}
73 109
111^d

$\gamma(0.100\gamma)$ delay = 1.3×10^{-9}s

A.W.Sunyar, Phys. Rev. 98, 653 (1955); 95, 626A (1954).

Resonance Ta^{181}(n)
4.30 ev $\sigma_0\Gamma^2 = 49$ *7*

T.F.Godlove, J.G.Carver, Phys. Rev. 99, 1634A (1955).

Resonances Ta^{181}(n) E_n = 7 to 150 ev

E_o (ev)		Γ_n (10^{-3}ev)*		E_o (ev)		Γ_n (10^{-3}ev)*	
10.38	*10*^{1}	4.5	*5*	57.5	*7*	0.5	*2*
13.95	*12*^{2}	1.04	*8*	62.9	*8*	10	*2*
20.5	*2*^{3}	1.12	*10*	77.2	*13*	40	*7*
22.8	*3*	0.25	*4*	83.4	*14*	21	*6*
24.0	*3*	6.1	*7*	91.3	*18*	7	*2*
30.1	*3*	0.23	*5*	99.8	*19*	125	*25*
35.4	*4*	17	*2*	106	*2*	16	*6*
36.1	*4*	18	*2*	116	*2*	64	*16*
39.3	*5*	51	*5*	127	*3*	28	*10*
49.4	*6*	1.1	*3*	Others with $E_o > 45$ ev?			

*Based on $\bar{\Gamma}_\gamma = 0.050 \pm 0.010$ ev chopper
Γ_γ(measured) = ^{1}0.049 ± 0.011, ^{2}0.055 ± 0.013, and ^{3}0.049 ± 0.015 ev
No additional resonance at ~11 ev

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10, 611A (1955).

Resonances Ta^{181}(n) E_n = 13 to 147 ev

E_o (ev)
22.9
35
36

chopper, cryst

F.B.Simpson, R.G.Fluharty, O.D.Simpson, Phys. Rev. 99, 610A (1955); verbal report.

Ta^{183}
73 110
5^d

τ 5.2^d Ta^{181}(pile n)
β^- >95% 0.615 *10* sl
<5% <1.0 sl ce, cryst

γ			α_K	α_{L_1}	α_{L_2}	α_{L_3}
M1	22†	0.04097		11.5		0.8
M1	220†	0.04648*		7.4	1.05	0.5
M1	240†	0.05259*		3.8	0.9	0.55
(M1)	11†	0.08292		1.4		
M1	70†	0.08470*		1.1		
E2	220†	0.09907*	1.4		1.55	1.45
M1	9.5†	0.10194	5.4			
M2	4†	**0.10249	3.5	6.0		
(E2)	5†	0.10314				
M1	350†	0.10793*	3.8	0.6		
(M1)	17†	0.10973				
M1	3†	0.12038	2.1			

(Continued)

Ta^{183}
73 110
5^d

γ			α_K	α_{L_1}	α_{L_2}	α_{L_3}
M1	15†	**0.14225		0.35		
M1	85†	0.14412*	1.65	0.30		
E2	105†	0.16053	0.4			
M1	310†	0.16136	1.15			
M1	165†	0.16233	1.10			
M1	9†	0.19264	0.65			
M1	9†	0.20327	0.65			
M1	35†	0.20506	0.6	0.13		
M1	26†	0.20881	0.7			
E2	165†	0.20987	0.22		0.065	0.03
E2	340†	0.24426	0.15			
M1	1000†	0.24605	(0.38)	0.07		
E2	200†	0.29171	0.07		0.022	
M1	300†	0.31302	0.22	0.035		
M1	400†	0.3540	0.14	0.025		
(M1)	35†	0.3656				
(E2)	40†	0.4066				

*M and N conversion data given
**Not assigned in proposed decay scheme
α's based on $\alpha_K(0.24605\gamma) = 0.38$

J.J.Murray, F.Boehm, P.Marmier, J.W.M.DuMond, Phys. Rev. 97, 1007 (1955); 92, 202; 96, 858A (1954).

τ 5.0^d *1* W(≤50-Mev n) chem
β^- ~30% ~0.15 a
~70% 0.6 scin

γ		
	100†	0.060 + K x ray
	20†	0.110
	20†	0.160
	12†	0.210
	40†	0.240
	70†	0.320

A.J.Poë, Phil. Mag. 46, 611 (1955).

Ta^{184}
73 111
8.7^h

τ 8.7^h *1* W^{184}(fast n,p) chem
β^- ~30% ~0.15 a
~70% 1.26 *7* scin

γ					
	40†	K x ray	35†	0.300	scin
	30†	0.110	100†	0.405	
	10†	0.160	17†	0.780	
	10†	0.210	90†	0.890	
	60†	0.240	50†	1.160	

F.D.S.Butement, A.J.Poë, Phil. Mag. 46, 482 (1955).

Ta^{185}
73 112
49^m

W^{186}(≤50-Mev n,pn) chem
τ 49.5^m *15*
β^- ~30% ~0.15 a
~70% 1.72 scin

γ		
	100†	0.060 + K x ray
	28†	0.125
	71†	0.175
	18†	0.235

A.J.Poë, Phil. Mag. 46, 611 (1955).

W
74

Abundances
W^{185} $<$0.0002% ms
W^{187} $<$0.0001%

F.A.White, T.L.Collins, F.M.Rourke, Phys. Rev. 98, 1174A (1955).

Levels W(p,p'γ) E_p = 4.0; γ scin
$\sim$0.112 $\tau = 780^{\mu\mu s *}$ (α = 3.16)
*Average half-life for the 0.100, 0.112, and 0.124 levels of W^{182}, W^{184}, and W^{186} resp.

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112 (1955).

W(n,n'γ) E_n = 4.4; γ scin
γ 59+ 0.64 *2*
100+ 0.77 *2*

R.W.Sinclair, Phys. Rev. 99, 621A (1955); verbal report.

W^{179}
74 105

Ta^{181}(32-Mev p, 3n)
No activity with $2^m < \tau < 25^m$

S.D.Softky, Phys. Rev. 98, 736, 280A (1955).

W^{180}
74 106
0.006^s

Ta^{181}(13-Mev p, 2n)
τ 0.0055^s *3* not by W(32-Mev p)
γ 0.22 ? scin
$\sim$0.35

S.D.Softky, Phys. Rev. 98, 736, 280A (1955).

W^{181}
74 107
140^d

No β^+, no ce sl
No $\sim$0.15γ ($< 10^{-3}$% of K x ray) scin
(L x ray)/(K x ray) = 0.39 *1* pc
from which ϵ_L/ϵ_K = 1.54
and E_{dis} = 0.92 *9*

A.Bisi, S.Terrani, L.Zappa, Nuovo Cim. 1, 651 (1955).

W^{182}
74 108
stable

Level W$^{(182)}$($\alpha,\alpha'\gamma$) E_α = 2.75
γ 0.106 K/L $<$ 1 E2 sπ ce

E.M.Bernstein, H.W.Lewis, Phys. Rev. 99, 617A (1955); verbal report.

W^{183}
74 109
stable

μ +0.115 *1** Metallic W I
ν(W^{183})/ν(H^2) = 0.27395 *3*
*Corrected for Knight shift for metal

P.B.Sogo, C.D.Jeffries, Phys. Rev. 98, 1316, 265A (1955).

W^{183}
74 109
stable

Level W$^{(183)}$(p,p'γ) E_p = 4.0; γ scin
0.295 *5* ϵB(E2) = 0.27

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112 (1955).

W^{183}
74 109
5.5^s

τ $\sim$5.5^s W(fast n)
γ 100+ 0.060 +K x ray scin
25+ 0.105
10+ 0.155

A.J.Poë, Phil. Mag. 46, 611 (1955).

W^{184}
74 110
stable

Level W$^{(184)}$($\alpha,\alpha'\gamma$) E_α = 2.75
γ 0.116 K/L $<$ 1 E2 sπ ce

E.M.Bernstein, H.W.Lewis, Phys. Rev. 99, 617A (1955); verbal report.

W^{185}
74 111
73^d
g.s.

τ 74.5^d W(pile n)
γ 0.056 scin
0.570
0.770

W.E.Kreger, L.D.McIsaac, J.L.Mackin, J.R.Lai, Phys. Rev. 100, 955A, 953 (1955).

β^- 10+ (0.370) W$^{(184)}$(pile n,γ)
90+ 0.426 *3* sl
γ 2.4+ 0.0556 *1* $\alpha_L \sim 3$ M1 pc, scin
x $\sim$0.7+ L x ray
No 0.13γ, 0.29γ scin

A.Bisi, S.Terrani, L.Zappa, Nuovo Cim. 1, 291 (1955).

W^{185} ?
74 111
73^d

W(pile n,γ)
γ 17+ 0.060 +K x rays ? scin
100+ 0.134
β/(0.060γ+0.134γ) = 0.11

A.M.Mijatovic, Bull. Inst. Nuclear Sci., Boris Kidrich 4, 75 (1954).

W^{185}
74 111
1.6^m

τ 1.62^m *5* W^{184}(n,γ)
γ 100+ 0.060 +K x ray ?
50+ 0.130
50+ 0.165
(0.165γ)(0.130γ, K x ray)
Not d 49^{m}Ta ($<$0.6%) chem

A.J.Poë, Phil. Mag. 46, 611 (1955).

W^{186}
74 112
stable

Level W$^{(186)}$($\alpha,\alpha'\gamma$) E_α = 2.75
γ 0.126 K/L $<$ 1 E2* sπ ce

E.M.Bernstein, H.W.Lewis, Phys. Rev. 99, 617A (1955); verbal report.

Re
75

Resonances Re(n) $E_n = 1$ to 14 ev

E_0 (ev)	Γ_γ (10^{-3}ev)	σ_t	
2.157	48	13700	cryst
4.4	45		
~5.9			
~7.2			
~11.3			
11.9			

G.Igo, Phys. Rev. 99, 610A (1955); verbal report.

Re^{180}
75 105
2.4^m

τ 2.42^m *7* W$^{(182)}$ (20-Mev p,3n)
β^+ 20+ 1.1 *1* a
γ 0.106 *10* scin
100+ 0.880 *40*
x K x ray

V.K.Fischer, Phys. Rev. 99, 764, 672A (1955).

Re^{185}
75 110
stable

J 5/2 Mic
q(Re^{185})/q(Re^{187}) = 1.07 ± 0.05

A.Javan, A.Engelbrecht, Phys. Rev. 96, 649 (1954); 91, 222A (1953).

Levels Re^{185}(p,p'γ)
γ 0.130 *4* scin
0.290 *17*

C.McClelland, H.Mark, C.Goodman, Phys. Rev. 97, 1191 (1955); 98, 249A (1955).

Re^{186}
75 111
3.8^d

β^- 0.05% ~0.3 sl $\beta\gamma$
24% 0.934* sl $\beta\gamma$,pc
76% 1.0715* *10* sl,pc
(E_β = 0.9)(0.137 γ)(θ) $\eta(\pi)$ = +0.13
*F-K plot non-linear, not ΔJ = 2, yes shape
Different ratio of matrix elements are needed to fit angular correlation and β spectrum shape

F.T.Porter, M.S.Freedman, T.B.Novey, F.Wagner, Jr., Phys. Rev. 98, 214 (1955); Phys. Rev. 99, 671A (1955); verbal report.

Re^{187}
75 112
?

J 5/2 Mic
q(Re^{185})/q(Re^{187}) = 1.07 ± 0.05

A.Javan, A.Engelbrecht. Phys. Rev. 96, 649 (1954); 91, 222A (1953).

τ > 10^{16}y pc
No β with E_β > 0.001
L x rays observed from Re, Os, Pt, W believed produced by background γ's

D.Dixon, A.McNair, Phil. Mag. 45, 1099 (1954). J. phys. radium 16, 538 (1955).

Re^{187}
75 112
?

Levels Re^{187}(p,p'γ)
γ 0.139 *4* scin
0.320 *19*

C.McClelland, H.Mark, C.Goodman, Phys. Rev. 97, 1191 (1955); 98, 249A (1955).

Re^{188}
75 113
16.9^h

τ 16.7^h *5* W$^{(186)}$ (slow n) chem
β^- 2.01 s

B.S.Dzhelepov, N.D.Novosil'tseva, P.A.Tishkin, Izvest. Akad. Nauk Ser. Fiz. SS SR 18, 76 (1954).

β(0.155γ) delay = 7×10^{-10}s

A.W.Sunyar, Phys. Rev. 98, 653 (1955); 95, 626A (1954).

Re^{190}
75 115
2.8^m

Os$^{(192)}$ (21-Mev d,α) chem
Os$^{(190)}$ (fast n,p)
τ 2.8^m *5*
β^- 1.7 *3* a
γ ~10+ 0.191 scin
~10+ 0.392
~10+ 0.569
~3+ 0.830
E_γ/β ~1.5 Mev a

A.H.W.Aten, Jr., G.D.deFeyfer, Physica 21, 543 (1955).

Os^{187}
76 111
stable

J 1/2 s
μ +0.12 *4*

K.Murakawa, Phys. Rev. 98, 1285 (1955).

τ_ϵ > 10^{15}y pc
L x rays observed from Re, Os, Pt, W believed produced by background γ's

D.Dixon, A.McNair, Phil. Mag. 45, 1099 (1954); J. phys. radium 16, 538 (1955).

Os^{190}
76 114
10^m

τ 10^m *2* d 3.2^{h}Ir chem
γ 75+ 0.186 scin
90+ { (0.356)
(0.401)
100+ 0.560 double
92+ 0.620
x 23+ K x ray

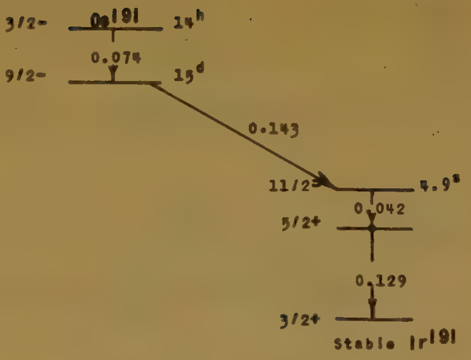
A.H.W.Aten, Jr., G.D.de Feyfer, M.J.Sterk, A.H.Wapstra, Physica 21, 740 (1955).

Os^{191}
76 115
14^h

γ 0.0742 E4 1-2% M3 ~98%
$L_1 : L_2 : L_3$ = 55 : 15 : 100
No β^- (< 5%)

J.W.Mihelich, M.Goldhaber, Phys. Rev. 98 1185A (1955); verbal report.

Os^{191}
76 115



Ir
77

Resonances Ir(n) E_n = 0.1 to 10 ev

E_0 (ev)	Γ_γ (10^{-3}ev)	A*
0.654	74 ± 5	192
1.305	87 ± 3	194
5.36	65 ± 5	?

*Assignment from activation

H.H.Landon, Phys. Rev. 99, 610A (1955); verbal report.

Ir^{187}
77 110
12^h

τ		14^h *2*	d 2.5^hPt	chem
γ	100+	0.135 *10*		scin
	110+	0.300 *10*		
	80+	0.435 *15*		

W.G.Smith, J.M.Hollander, Phys. Rev. 98, 1258, 262A (1955).

Ir^{188}
77 111
41^h

Ir(191) (32-Mev p,p3n) chem

τ		41^h *4*	d 10.3^dPt	chem
γ	90+	0.150 *10*		
	60+	0.475 *10*		
	100+	0.625 *15*		

W.G.Smith, J.M.Hollander, Phys. Rev. 98, 1258, 262A (1955).

Ir^{189}
77 112
11^d

Ir(191)(25-Mev p, p2n) chem

τ	11^d *2*	d 10.5^hPt	chem
γ	~0.135 ?		scin
	0.245 *10*		

W.G.Smith, J.M.Hollander, Phys. Rev. 98, 1258, 262A (1955).

Ir^{190}
77 113
11^d
g.s.

τ		11^d	Ir(191) (fast n,2n)	chem
γ	75+	0.186		scin
	~30+	(0.356)		
	~55+	(0.401)		
	145+	0.560	double	
	17+	0.800		
	2+	1.330		
x	60+	K x ray		

(0.186γ)(0.356γ, 0.401γ)

A.H.W.Aten, Jr., G.D.de Feyfer, M.J.Sterk, A.H.Wapstra, Physica 21, 740 (1955).

Ir^{190}
77 113
11^d
g.s.

γ	0.186	sl ce
	0.356	
	0.401	
	0.557	
	0.604	

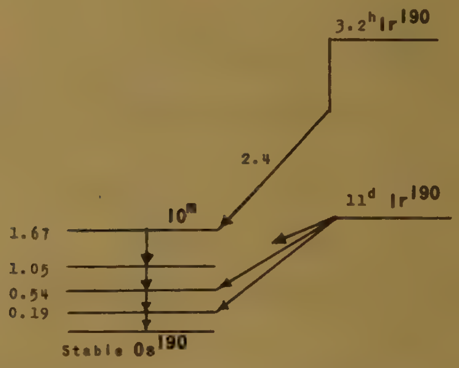
G.J.Nijgh, L.T.M.Ornstein, A.H.Wapstra, quoted by Aten et al., Physica 21, 740 (1955).

Ir^{190}
77 113
3.2^h

Ir(191) (fast n,2n) chem

β^+		2.04 ?		scin
γ	75+	0.186		scin
	115+ {	(0.356)		
		(0.401)		
	115+	0.560	double	
	103+	0.620		
	3+	0.920		
	7+	1.090	double	
x	95+	K x ray		

0.186γ, 0.356γ, 0.56γ, 0.62γ in 4-fold coinc



A.H.W.Aten, Jr., G.D.de Feyfer, M.J.Sterk, A.H.Wapstra, Physica 21, 740 (1955).

Ir^{191}
77 114
4.9^s

τ	5.6^s *4*	d 15^dOs	chem
γ	(0.042)		
	(0.129)		

R.A.Naumann, J.G.Gebhart, Phys. Rev. 96, 1452 (1954).

τ	6.8^s *1*	Ir^{191}(fast n,n'γ)	
γ	(0.042)		
	(0.129)	$\tau < 5\times10^{-10}s^*$	scin

J.W.Mihelich, M.McKeown, M.Goldhaber, Phys. Rev. 96, 1450 (1954); *A.W.Sunyar, ibid.

τ	4.91^s *14*	Ir(15-Mev p)	
γ	(0.042)	a_L large	scin
	0.135 *10*	a_K = 2.7	x/γ

V.K.Fischer, Phys. Rev. 99, 764, 672A (1955).

Ir^{192}
77 115
74.4^d
g.s.

β^- 0.672 Ir$^{(191)}$(pile n,γ); sl

γ	2.6†	0.1362 *3*	57†	0.4678 *1*	sl pe
	0.8†	0.1740 *4*	5.2†	0.4844 *2*	
	0.8†	0.2012 *3*	6.4†	0.5887 *3*	
	3.5†	0.2054 *2*	10†	0.6045 *3*	
	1.0†	0.2815 *5*	7.7†	0.6127 *2*	
	26†	0.2958 *1*	0.06†	0.745 *3*	
	28†	0.3084 *1*	0.05†	0.783 *2*	
	77†	0.3165 *1*	0.9†	0.8854 *10*	
	0.5†	0.374 *2*	0.15†	1.065 *2*	
	0.5†	0.440 *2*	0.08†	1.157 *2*	

M.W.Johns, S.V.Nablo, Phys. Rev. 96,1599(1954)

		Dipole/Quadrupole	
γ	(0.296)	2.5/97.5	$\gamma\gamma(\theta)$
	(0.308)	0/100	
	(0.316)	0/100	
	(0.468)	94/6 or 0/100	

($\sim$0.3γ)($\sim$0.3γ)(θ) J=4, 2, 2, 0
(0.468γ)(0.316γ)(θ) J=3, 2, 0 or 4, 2, 0

H.W.Taylor, R.W.Pringle, Phys. Rev. 99, 1345 (1955).

γ	137†	0.31	(3 unresolved γ's)	scin
	49†	0.47	(2 unresolved γ's)	
	27†	0.60	(3 unresolved γ's)	
x	13†	K x ray		

†Photons per 100 β^-

M.Jaffe, UCRL-2537 (1954).

Ir^{192}
77 115
1.42^m

τ	1.42^m	Ir$^{(191)}$(pile n,γ)	
γ	0.0580 *4*	L_2/L_3 = 1.1	87 ce
		α_L > ~870 E3	scin

No $\gamma\gamma$ (< 1% of count expected for 2 quantum decay)
Continuum ≤ 50 kev attributed to bremsstrahlung (< 0.01 quantum/ce)

J.P.Mize, M.E.Bunker, J.W.Starner, Phys. Rev. 96, 444; 95, 627A (1954).

Ir^{194}
77 117
19^h

β^-	~8%	0.430	Ir$^{(193)}$(pile n,γ); sl		
	9.7%	0.975			
	15%	1.905			
	66%	2.236 *10*			
γ	5.1†	0.2930 *3*	0.3†	1.339 *2*	sl pe
	27†	0.3281 *2*	0.8†	1.466 *1*	
	< 3†	0.466	0.2†	1.478 *1*	
	1.7†	0.6200 *10*	0.3†	1.507 *2*	
	6.2†	0.6433 *6*	0.3†	1.618 *2*	
	2.9†	0.9374 *4*	0.2†	1.662 *3*	
	2.9†	1.1492 *6*	0.3†	1.802 *2*	
	1.7†	1.180 *1*	0.05†	2.048 *4*	
	0.4†	1.216 *1*			

M.W.Johns, S.V.Nablo, Phys. Rev. 96, 1599 (1954).

Ir^{194}
77 117
19^h

				Ir^{193}(pile n,γ)	
β^-		0.74		scin $\beta\gamma$	
		0.94		scin $\beta\gamma$	
		1.88		scin $\beta\gamma$	
γ	(200†)	0.295		1.28 ?	scin
	1000†	0.325	18†	1.45	
	100† {	0.635		1.58 ?	
		0.640	9†	1.77	
	76†	0.93	2†	2.00	
	85†	1.14			

(0.74β)(1.14γ) (1.88β)(0.325γ) scin
(0.94β)(0.93γ) scin
(0.325γ)(0.295γ, 0.93γ, 1.14γ, 1.45γ)
($\sim$0.64γ)(0.295γ, 0.325γ, 0.93γ)
(0.64γ)(0.63γ)
(0.295γ)(0.325γ)(θ) J = 2, 2, 0
No (0.295γ)(0.93γ, 1.14γ)
No (0.325γ)(E_γ > 1.6)
1.14γ and 1.45γ in coincidence with 0.325γ only

C.E.Mandeville, J. Varma, B.Saraf, Phys. Rev. 98, 94, 1185A (1955).

Pt
78

Level Pt(p,p'γ) E_p = 2.0 to 4.0

γ 0.345 scin
Anisotropy in p,$\gamma(\theta)$ studied as f(E_p)

W.I.Goldburg, Phys. Rev. 99, 617A (1955).

Pt^{187}
78 109
2.5^h

τ	2.5^h *5*	Ir(120-Mev p)	chem
	not by	Ir(32-Mev p)	chem
		p 12^{h}Ir	chem

W.G.Smith, J.M.Hollander, Phys. Rev. 98, 1258, 262A (1955).

Pt^{188}
78 110
10.3^d

		Ir$^{(191)}$(32-Mev p,4n)	chem
τ		10.0^d *3*	p 41^{h}Ir chem
γ	100†	0.195 *10*	
	10†	0.275 *10*	
	30†	~0.40	

W.G.Smith, J.M.Hollander, Phys. Rev. 98, 1258, 262A (1955).

Pt^{189}
78 111
10.5^h

		Ir$^{(191)}$(18-Mev p,3n)		chem
τ	10.5^h *10*	d 42^{m}Au		p 11^{d}Ir
γ	0.14 *1*		≥0.55 ?	scin
	~0.55 ?		~0.70 ?	

W.G.Smith, J.M.Hollander, Phys. Rev. 98 1258, 262A (1955).

Pt^{191}
78 113
3.0^d

τ 3.0^d *3* d 3^hAu chem

γ			scin
	~50+	0.125 *10*	
	~40+	0.175 *10*	
	20+	0.265 *10*	
	100+	0.355 *10*	
	80+	0.405 *10*	
	20+	0.445 *20*	
	170+	0.530 *10*	

W.G.Smith, J.M.Hollander, Phys. Rev. 98, 1258, 262A (1955).

γ sd ce
0.042
0.047
0.082
0.097
0.129
0.172
0.179
0.188
0.219
0.221
0.223
0.267
0.268
0.271
0.352
0.361
0.410
0.447
0.458
0.496
0.540
0.543
0.571
0.585
0.590
0.626

E.P.Tomlinson, R.A.Naumann, Phys. Rev. 100, 955A (1955).

$\gamma(0.082\gamma)$ delay $= 3.8 \times 10^{-9s}$
$\gamma(0.129\gamma)$ delay $< 0.5 \times 10^{-9s}$

A.W.Sunyar, Phys. Rev. 98, 653 (1955).

Pt^{193}
78 115
3.4^d

τ 3.5^d *4* source: 12^hHg
γ 0.1345 $s\pi$ ce
$K : L_1 : L_3 : M = 1 : 2 : 4 : 1$
d 3.8^sAu 0.03%

J.Brunner, H.Guhl, J.Halter, O.Huber, Helv. Phys. Acta 28, 85 (1955).

Pt^{194}
78 116
stable

Level $Pt^{194}(p,p'\gamma)$ $E_p = 3.0$; γscin
0.330 *10*

C.McClelland, H.Mark, C.Goodman, Phys. Rev. 97, 1191 (1955); 94, 1437A (1954).

Level $Pt^{(194)}(p,p'\gamma)$ $E_p = 2.5$ to 5.0
(0.330) γscin
$p,\gamma(\theta)$ shows large deviation from theory
See Phys. Rev. 91, 1578 (1953)

P.H.Stelson, F.K.McGowan, Phys. Rev. 98, 249A (1955).

Level $Pt^{(194)}(p,p'\gamma)$ $E_p = 5.0$; γ scin
0.330 *5* $\tau = 38^{\mu\mu s}$ $(\alpha = 0.074)$

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112 (1955).

Pt^{195}
78 117
stable

γ $Pt^{195}(p,p'\gamma)$ $E_p = 3.0$; γscin
0.210 *6*

C.McClelland, H.Mark, C.Goodman, Phys. Rev. 97, 1191 (1955); Phys. Rev. 91, 760 (1953).

γ $Pt^{(195)}(p,p'\gamma)$ $E_p = 5.0$; γ scin
0.100 *3* 0.210 *3*
0.130 *3* 0.240 *3*

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112 (1955).

Pt^{196}
78 118
stable

Level $Pt^{196}(p,p'\gamma)$ $E_p = 3.0$; γscin
0.360 *11* scin

C.McClelland, H.Mark, C.Goodman, Phys. Rev. 97, 1191 (1955).

Level $Pt^{(196)}(p,p'\gamma)$ $E_p = 2.5$ to 5.0
(0.360) γscin
$p,\gamma(\theta)$ shows large deviation from theory
See Phys. Rev. 91, 1578 (1953)

P.H.Stelson, F.K.McGowan, Phys. Rev. 98, 249A (1955).

Level $Pt^{(196)}(p,p'\gamma)$ $E_p = 5.0$; γ scin.
0.358 *5* $\tau = 35^{\mu\mu s}$ $(\alpha = 0.060)$
$J = 2^+$ $p,\gamma(\theta)$

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112, 127 (1955).

Resonances $Pt^{195}(n)$ chopper

E_o (ev)	Γ(ev)
11.9	0.17
19.5	0.12
68.0	
120	
153	

A.Stolovy, J.A.Harvey, Phys. Rev. 99, 611A (1955); priv. comm.

Pt^{197}
78 119
18^h

β^- scin$\beta\gamma$
0.468
0.479
0.670

γ			scin
	30+	0.077	
	3.9+	0.191	
	1.0+	0.279	

$(0.077\gamma)(0.191\gamma)$

V.R.Potnis, C.E.Mandeville, J.S.Burlew, Phys. Rev. 99, 671A (1955); verbal report.

$\beta(0.077\gamma)$ delay $= 1.9 \times 10^{-9s}$

A.W.Sunyar, Phys. Rev. 98, 653 (1955).

$_{78}Pt^{198}_{120}$ stable	Level	$Pt^{198}(p,p'\gamma)$ 0.425 *13*	$E_p = 3.0$; γ scin

C.McClelland, H.Mark, C.Goodman, Phys. Rev. 97, 1191 (1955); 98, 249A (1955).

	Level	$Pt^{(198)}(p,p'\gamma)$ 0.403 *5* $\tau = 19^{\mu\mu s}$ $J = 2^+$	$E_p = 5.0$; γ scin $(\alpha = 0.042)$ $p,\gamma(\theta)$

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112, 127 (1955).

$_{78}Pt^{199?}_{121}$ 29^m	Resonance	$Pt^{(198?)}(n)$ E_o (ev) 96.0	chopper

A.Stolovy, J.A.Harvey, Phys. Rev. 99, 611A (1955); priv. comm.

$_{79}Au^{187}_{108}$ $\sim 15^m$	τ	$\sim 15^m$	Pt(130-Mev p) p 2.5^hPt	chem chem

W.G.Smith, J.M.Hollander, Phys. Rev. 98, 1258, 262A (1955).

$_{79}Au^{188}_{109}$ $\sim 10^m$	τ	$\sim 10^m$	Pt (130-Mev p) p 10.3^dPt	chem chem

W.G.Smith, J.M.Hollander, Phys. Rev. 98, 1258, 262A (1955).

$_{79}Au^{189}_{110}$ 42^m	τ		42^m *5*	Pt(130-Mev p) $Ta^{181}(C^{12},4n)$ d$\sim 20^m$Hg p 10.5^hPt	chem chem
	γ	$\sim 10†$	0.135 *10*		scin
		100†	0.290 *10*		
			>0.80 ?		

W.G.Smith, J.M.Hollander, Phys. Rev. 98, 1258, 262A (1955).

$_{79}Au^{191}_{112}$ 3^h				Pt(130-Mev p)		chem
	τ		3.0^h *5*	d 57^mHg	p 3.0^dPt	
	γ	10†	0.14 *2*	4†	0.48 2	scin
		60†	0.30 *1*	10†	0.60 2	
		5†	0.39 *2*			
	x	100†	K x ray			

No evidence for 18^h or 1^d Au^{191} from yield of 3.0^dPt

W.G.Smith, J.M.Hollander, Phys. Rev. 98, 1258, 262A (1955).

$_{79}Au^{192}_{113}$ 4.8^h	τ	4.8^h	$Au^{197}(p)$	Hg(p)	chem
	γ	0.1365	0.401		s ce
		0.1577	0.4155		
		0.1734	0.4355		
		0.2054	0.467		
		0.2818	0.588		
		0.2957	0.612		
		0.3081	0.783		
		0.3160	1.158		

G.T.Ewan, A.L.Thompson, Proc. Roy. Soc. Canada 47, 126A (1953); and quoted by M.W.Johns, S.V.Nablo, Phys. Rev. 96, 1599 (1954).

$_{79}Au^{193}_{114}$ 3.9^s	τ	/	3.8^s *3*	source:	12^hHg
	γ	99.5%	0.0324	E3	sl ce
		99.5%	0.2573	M1(+E2?)	
		0.5%	0.2898	M4	

(ce 0.032 γ)(0.257 γ) sl

p 3.4^dPt 0.03%

J.Brunner, H.Guhl, J.Halter, O.Huber, Helv. Phys. Acta 28, 85 (1955).

τ	3.88^s *25*		Pt(15-Mev p)
γ	0.255 *20*	$\alpha_K = 0.4$	scin x/γ

V.K.Fischer, Phys. Rev. 99, 764, 672A (1955).

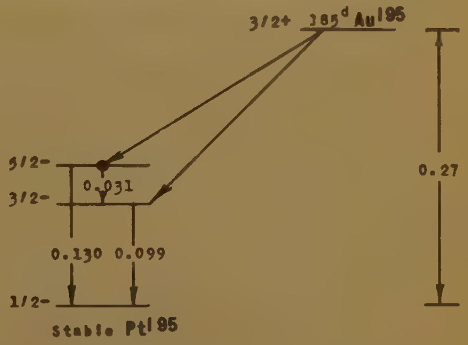
$_{79}Au^{195}_{116}$ 185^d g.s.			$Pt^{(196)}$(28-Mev d,3n)			chem
	γ	1.4†	(0.031)	$\alpha = 32$	M1	pc
		14†	(0.099)			
	x	41†	L x ray			
		100†	K x ray			

(L x ray)(L x ray, 0.031 γ)

ϵ_L/ϵ_K (to 0.130 level) = 0.58 ± 0.14

$E_{dis} = 0.14 + 0.13$ (E_γ)

Data indicate little if any ϵ to Pt^{195} g.s.



A.Bisi, L.Zappa, Nuovo Cim. 12, 539 (1954).

$_{79}Au^{195}_{116}$ 30^s	τ	30.6^s *2*	Au^{197}(20-Mev p,p2n)
	γ	0.26 *2*	scin

V.K.Fischer, Phys. Rev. 99, 764, 672A (1955).

Au^{197}
79 118
7.4^{s}

τ 7.2^{s} 3 Au^{197}(15-Mev p,p′)

γ 0.13 1 scin

0.27 1

V.K.Fischer, Phys. Rev. 99, 764, 672A (1955).

Au^{197}
79 118
stable

$Au^{197}(p,p'\gamma)$ $E_p = 3.50$

$Au^{197}(\alpha,\alpha'\gamma)$ $E_\alpha = 2.3$ to 3.5

γ 0.077 sp ce

0.191

0.279 K/L = 5.7

E2/M1 = 0.56

Direct excitation of 0.077 level established

E.M.Bernstein, H.W.Lewis, Phys. Rev. 99, 617A (1955); verbal report.

Levels $Au^{197}(p,p'\gamma)$ $E_p = 1.6$ to 5.0

0.077 level scin

γ not observed $\epsilon B(E2) < 0.03$

0.268 level

γ 0.191 3 $\epsilon B(E2) = 0.18$

No 0.077 γ

0.277 level J = 5/2+ $p,\gamma(\theta)$

γ 0.277 3 E2/M1 ~ 0.6 $p,\gamma(\theta)$

$\epsilon B(E2) = 0.25$

0.550 level J = 7/2+ $p,\gamma(\theta)$

γ 2.6+ (0.273) $\gamma\gamma/\gamma$

2.6+ (0.277) $\gamma\gamma/\gamma$

100+ 0.550 5 $\epsilon B(E2) = 0.46$ scin

No 0.282 γ (<0.5+) $\gamma\gamma/\gamma$

No 0.473 γ (<3+) scin

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112, 127 (1955).

Level $Au^{197}(n,n'\gamma)$ $E_n = 0.2$ to 2

(0.279) γ scin

Yield indicates level is not rotational

J.B.Guernsey, A.Wattenberg, Phys. Rev. 98, 1147A (1955); verbal report.

Levels $Au^{197}(p,p'\gamma)$ $E_p = 2.0$ to 5.0

0.279 level J = 5/2+ $p,\gamma(\theta)$

γ 0.279 E2/M1 ~ 0.7

0.555 level J = 7/2+ $p,\gamma(\theta)$

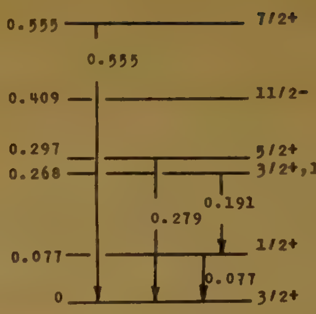
γ 0.555

No 0.276 γ (< 5% of 0.555 γ) from no(0.279γ)γ

No 0.478 γ

(Continued)

Au^{197}
79 118
stable



Stable Au^{197}

C.F.Cook, C.M.Class, J.T.Eisinger, Phys. Rev. 94, 744, 747A; 95, 628A; 96, 658 (1954).

γ $Au^{(197)}(n,n'\gamma)$ $E_n = 2.5$

0.25 1.38

0.54 1.98

0.98

(0.25 γ)(0.98 γ, 1.38 γ, 1.98 γ)

No (0.54 γ)γ

V.E.Scherrer, W.R.Faust, B.A.Allison, Phys. Rev. 98, 224A (1955).

Au^{198}
79 119
2.70^{d}

J 2 M

μ probably positive*

J.B.Reynolds, R.L.Christensen, D.R.Hamilton, A.Lemonick, F.M.Pipkin, H.H.Stroke, Phys. Rev. 99, 613A (1955); *verbal report.

τ 2.686^{d} 5 differential ic

J.Tobailem, J. phys. radium 16, 48 (1955).

β^- (1.371) $\Delta J = 2$, yes shape sl

L.G.Elliott, M.A.Preston, J.L.Wolfson, Can. J. Phys. 33, 607 (1955).

γ 0.675 $\alpha_K = 0.016$ 3 s

Taking E2/M1 = 60/40(1) theoretical α_K is 0.026(2) or 0.019(3)

(1) C.D.Schrader, Phys. Rev. 92, 928 (1953); D.Schiff, F.R.Metzger, Phys. Rev. 90, 849 (1953).

(2) M.E.Rose, et al., Phys. Rev. 83, 79 (1951), and privately circulated tables (1955).

(3) L.A.Sliv, M.A.Listengarten, Zhur. Ekspt'l i Teoret. Fiz. 22, 29 (1952); J. phys. radium 16, 523 (1955).

G.W.Hinman, R.D.Leamer, Carnegie Inst. Tech., NP-5109 (1954); NSA 8-3105, (1954).

Au^{198}
79 119
2.70^d

Resonance $Au^{197}(n)$ $E_n = 0.4$ to 15 ev
4.906 *10* ev cryst
$\Gamma = 0.140$ *3*
$\sigma_o = 37{,}000$ *500*
$\Gamma_\gamma = 0.124$ *3*

R.E.Wood, H.H.Landon, V.L.Sailor, Phys. Rev. 98, 639 (1955).

Resonance $Au^{197}(n)$ $E_n = 1$ to 14 ev
(4.94 ev) $\sigma_s\Gamma^2 = 75.4$ cryst
$\sigma_s/\sigma_t = 0.106$

H.L.Foote, Jr., J.Moore, Phys. Rev. 98, 1161A (1955).

Au^{199}
79 120
3.16^d

J 3/2 M

J.B.Reynolds, R.L.Christensen, D.R.Hamilton, A.Lemonick, F.M.Pipkin, H.H.Stroke, Phys. Rev. 99, 613A (1955).

β^-	24.3%	0.251	sl
	69.3%	0.302	
	6.4%	0.460	

e_A per L, L_2, L_3 vacancy = 0.63, 0.58, 0.68 resp.

S.K.Haynes, W.T.Achor, J. phys. radium 16, 635 (1955).

β(ce 0.209γ) delay $\sim 70^{\mu\mu s}$ sl

R.L.Graham, R.E.Bell, L.Yaffe, J.S.Geiger, Phys. Rev. 99, 1646A (1955).

Hg
80

γ		Hg(n,n'γ)	$E_n = 3.2$	scin
	st	0.38	1.21	
		0.54	2.0	
		0.90		

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Hg^{189}
80 109
$\sim 20^m$

Au^{197}(120-Mev p,9n) chem
τ 20^m *10* p 42^mAu chem

W.G.Smith, J.M.Hollander, Phys. Rev. 98, 1258, 262A (1955).

Hg^{191}
80 111
57^m

τ 55^m *10* p 3^hAu chem
No $12^h Hg^{191}$ Au^{197}(120-Mev p,7n) chem

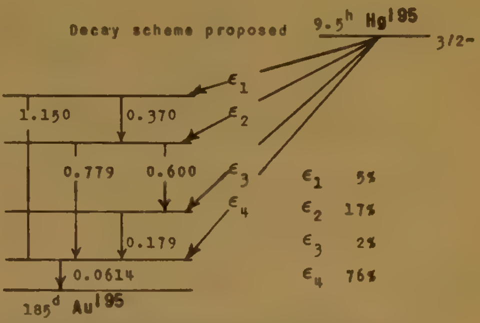
W.G.Smith, J.M.Hollander, Phys. Rev. 98, 1258, 262A (1955).

Hg^{193}
80 113

γ	0.570	source 12^hHg sl ce
	0.860	
	0.920	

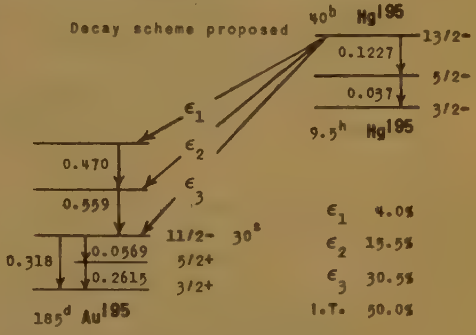
J.Brunner, H.Ghul, J.Halter, O.Huber, Helv. Phys. Acta 28, 85 (1955).

Hg^{195}
80 115
9.5^h
g.s.



Supporting coincidence data not given

Hg^{195}
80 115
40^h



Supporting coincidence data not given

J.Brunner, J.Halter, O.Huber, R.Joly, D.Maeder, Helv. Phys. Acta 27, 512A, 572 (1954).

Hg^{197}
80 117
65^h
g.s.

J 1/2 Au^{197}(15-Mev d,2n) chem
μ 0.52 *1* 8
$\mu(65^h Hg^{197})/\mu(Hg^{199}) = 1.033 \pm 0.016$

F.Bitter, S.P.Davis, B.Richter, J.E.R.Young, Phys. Rev. 96, 1531 (1954).

Hg^{197}
80 117
23^h

(ce 0.165γ)(0.134γ) delay 8×10^{-9s}
($ce_{K,L,M}$ 0.165γ)(0.134γ)(θ) suggests 0.134γ is E2 and 0.165γ is M4 + E5 sl ce, scin

H.H.Coburn, S.Frankel, Phys. Rev. 99, 671A (1955); verbal report.

(ce_K 0.165γ)(ce_K 0.134γ)(θ) — scin
$a_2 = 0.353$ *7* $a_4 = 0.026$ *8*
(Theoretical coefficients for M4 - E2 cascade: $a_2 = 0.450$ $a_4 = 0.032$). This discrepancy suggests 0.165γ is not pure M4.

E.Breitenberger, Nature 173, 737 (1954).

$_{80}\mathrm{Hg}^{198}_{118}$
stable

Level $\mathrm{Hg}^{(198)}(\gamma,\gamma)$ Au^{198} at 1125°C
γ (0.411) $J = 2$ $\gamma\gamma(\theta)$
$\tau = 2.3 \times 10^{-11}\mathrm{s}$ $\sigma(T)$

F.R.Metzer, W.B.Todd, Phys. Rev. 95, 853 (1954); 97, 1258 (1955); 98, 1187A (1955).

$_{80}\mathrm{Hg}^{199}_{119}$
44^{m}

τ 42^{m} *1* Hg(fast n)
γ 0.159 $\alpha_K = 0.34$ scin
0.368 $\alpha_K \sim 1$
(x ray)(0.159 γ, 0.368 γ)
(0.159 γ)(0.368 γ)(θ) $\eta(\pi) < 0$

H.H.Bolotin, R.G.Wilkinson, Phys. Rev. 99 671A (1955); verbal report.

$_{80}\mathrm{Hg}^{201}_{121}$
stable

q +0.45 *4* S

K.Murakawa, Phys. Rev. 98, 1285 (1955).

$_{80}\mathrm{Hg}^{202}_{122}$
stable

Level $\mathrm{Hg}^{(202)}(\gamma,\gamma)$ Tl^{202} at 1000°C
γ (0.439) $J = 2$ $\gamma\gamma(\theta)$
$\tau = 2.4 \times 10^{-11}\mathrm{s}$ $\sigma(T)$

F.R.Metzger, Phys. Rev. 98, 200 (1955).

$_{80}\mathrm{Hg}^{203}_{123}$
47^{d}

β^- 100% 0.214 *2* F-K linear sd $\beta\gamma$, sd
$< 4 \times 10^{-3}\%$ (0.493)
γ 0.279 $\alpha_K = 0.21$ sd ce
K : L : M = 14 : 4 : 1
30% M1 70% E2
No ce between 0.01 and 0.16 (< 0.7%)

N.Marty, Compt. rend. 240, 291 (1955).

γ (0.280) $\alpha_K = 0.147$ $s\pi$, scin
$\alpha_L = 0.045$ $\beta(\mathrm{ce})/\beta$
α_K, α_L gives E2/M1 = 3.0 x/γ

R.K.Doerner, A.H.Weber, Phys. Rev. 99, 672A (1955).

$\beta\gamma$ delay = $120^{\mu\mu s}$ *30*

H.de Waard, Phys. Rev. 99, 1045 (1955).

$\beta\gamma$ delay = $300^{\mu\mu s}$ *100*

R.E.Azuma, G.M.Lewis, Phil. Mag. 46, 1034 (1955).

$_{80}\mathrm{Hg}^{205}_{125}$
5.6^{m}

γ 0.203 $s\pi$ ce

W.C.Jordan, Michigan University, Dissertation Abstracts 14, 698 (1954).

$_{81}\mathrm{Tl}^{196}_{115}$
$\sim 4^{h}$

τ $\sim 4^{h}$ Tl(190-Mev p) chem
ϵ
γ 0.426 sd ce

G.Andersson, E.Arbman, I.Bergström, A.H.Wapstra, Phil. Mag. 46, 70 (1955).

$_{81}\mathrm{Tl}^{197}_{116}$
2.8^{h}

τ 2.8^{h} *4* Tl(190-Mev p) chem; ms
ϵ

γ	> 3*	0.134	$K/L \geq 0.1$	$L_1L_2/L_3 = 1.4$
	> 100*	0.152	$K/L > 2.5$	No L_3
	> 5*	0.174	$K/L \sim 5$	No L_3
	5*	0.269?		
	7*	0.434	$K/L \sim 6$	
	6*	0.583?		
	1*	0.588?		
	4*	0.611		
	3*	0.637?		

Energy range observed 0.05 to 0.70
*Relative intensity ce_K

G.Andersson, E.Arbman, I.Bergström, A.H.Wapstra, Phil. Mag. 46, 70 (1955).

$_{81}\mathrm{Tl}^{200}_{119}$
27^{h}

γ	5*	0.1163		sd ce
	4*	0.2521		
	2*	0.2891	?	
	100*	0.3676	K/L = 2.0	
	7*	0.5788	K/L = 4	
	1*	0.6284	?	
	1*	0.6602	?	
	1*	0.7884	K/L = 5	
	8*	0.828	K/L = 4	
	9*	1.205	K/L = 4.3	
	1*	1.224		
	1*	1.363		
	1*	1.515	*Relative intensity ce_k	

K.E.Bergkvist, I.Bergström, C.J.Herrlander, S.Hultberg, H.Slätis, E.Sokolowski, A.H.Wapstra, T.Wiedling, Phil. Mag. 46, 65, (1955).

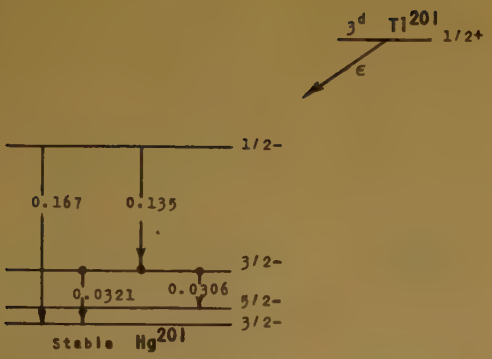
$_{81}\mathrm{Tl}^{201}_{120}$
3^{d}

			L_1/L_2	K/L	sd ce
γ		0.0306	10		M1
		0.0321	10		M1
	60*	0.1350	10	7.0	M1
	100*	0.1672	10	6.2	M1

(0.135 γ)(ce 0.030 γ, ce 0.032 γ) sl
No (0.167 γ)(ce 0.030 γ, ce 0.032 γ) sl
No (0.135 γ)(0.167 γ) No 0.1657 γ
(0.030 γ)/(0.032 γ) = 1.0
(0.167 γ)/(0.135 γ) = 3.2
*Relative intensity ce_K d 9.4^{h}Pb

(Continued)

Tl^{201}
81 120
3^d



K.E.Bergkvist, I.Bergström, C.J.Herrlander, S.Hultberg, H.Slätis, E.Sokolowski, A.H.Wapstra, T.Wiedling, Phil. Mag. 46, 65 (1955).

Tl^{202}
81 121
12^d

d $\sim 3\times10^{5y}$ Pb chem
$\epsilon_K/\epsilon_L \sim 2.3$ from K x ray/ L x ray = 2.6 scin

J.R.Huizenga, C.M.Stevens, Phys. Rev. 96, 548 (1954).

Tl^{203}
81 122
stable

$\nu(\text{Tl}^{205})/\nu(\text{Tl}^{203})$ = 1.009816 *22* I

H.E.Walchli, ORNL-1775 (1955).

Levels Tl$^{(203)}$ (p,p'γ) E_p = 4.0
Tl$^{(203)}$ (α,α'γ) E_α = 4.0

0.279 level
γ 0.279 *3* $\epsilon B(E2)$ = 0.11 scin

0.682 level
γ 0.279 *3* scin
0.410 *5*

(0.279 γ)(0.410 γ)

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112, 616A (1955).

γ Tl$^{(203)}$ (p,p'γ) E_p = 3.0 to 4.6
0.280 $\epsilon B(E2)$ = 0.10 scin
0.410 *6*

R.Barloutaud, T.Grjebine, M.Riou, Compt. rend. 240, 1207 (1955).

Tl^{204}
81 123

Tl$^{(203)}$ (10-Mev d,p) chem
τ 2.50^y *3*
No 4.0^y activity
Counted for 10 years
Identified with previously known 4^y Tl^{204}

L.T.Cheng, V.C.Ridolfo, M.L.Pool, D.N.Kundu, Phys. Rev. 98, 231A (1955).

Tl^{204}
81 123

τ 4.26^y *6* differential ic
Tl$^{(203)}$ (pile n,γ) chem

J.Tobailem, J.Robert, J. phys. radium 16, 340 (1955).

β^- 0.762 *5* sl
Includes correction of −0.003 for 3% resolution

L.Feuvrais, T.Yuasa, Compt. rend. 239, 1627 (1954).

Tl$^{(203)}$ (pile n, γ)
β^- 96% 0.765 *10* $\Delta J = 2$, yes shape* sl
ϵ Hg K x ray scin
4% e_{AK}/β = 0.003 sl
$e_{AL}/e_{AK} \sim 4$ sl
(0.0464 ce)/β = 0.001 but no 0.060 γ, 0.130 γ
No 0.37 γ (<0.01%) scin, sl
*Spectrum deviates from $\Delta J = 2$, yes shape below 0.4 Mev (excess of β's ~5%)

T.Yuasa, J.Laberrigue-Frolow, L.Feuvrais, J. phys. radium 16, 39, 165 (1955); Compt. rend. 238, 1500 (1954).

ϵ_K 1.8% 4π pc, scin
ϵ_L 0.6%
Hg K_α x ray cryst

H.Jaffe, UCRL-2537 (1954).

γ 0.008% 0.380 *15* sd pe

M.C.Joshi, Current Science 24, 227 (1955).

Resonance Tl^{203} (n) chopper

E_0 (ev)	Γ(ev)	J
238	~5	1

A.Stolovy, J.A.Harvey, Phys. Rev. 99, 611A (1955); priv. comm.

Tl^{205}
81 124
stable

Levels Tl$^{(205)}$ (p,p'γ) E_p = 4.0
Tl$^{(205)}$ (α,α'γ) E_α = 4.0

0.205 level scin
γ 0.205 *3* α = 0.9 ± 0.5 $\gamma\gamma/\gamma$
$\epsilon B(E2)$ = 0.072

0.615 level
γ 0.205 *3*
0.410 *5*

(0.205 γ)(0.410 γ)

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112, 616A (1955).

Tl^{205}	γ	$Tl^{(205)}(p,p'\gamma)$ $E_p = 3.0$ to 4.6		
81 124		0.205 *4*	$\epsilon B(E2) = 0.037$	scin
stable		0.410 *6*		

R.Barloutaud, T.Grjebine, M.Riou, Compt. rend. 240, 1207 (1955).

Tl^{208}	γ	0.252	s ce
81 127		0.763	scin, s ce
3.1^m			

Both γ's coincident with 2.62γ and probably from new level at 3.961

L.G.Elliott, R.L.Graham, J.Walker, J.C.Wolfson, Proc. Roy. Soc. Canada 48, 12A (1954).

Tl^{208}?	γ	100+	(2.62)	6.7^y Ra^{228} source
81 127		10+	3.19	$Be^9(\gamma,n)$ ppl

H.Niewodniczański, M.Wielowiejska, Bull. Acad. Polon. Sci., Cl. III, 1, 293 (1953); 2, 25 (1954).

γ	100+	(2.62)	6.7^y Ra^{228} source
	~8+	(3.19)	$Be^9(\gamma,n)$ cc

S.Wiktor, Bull. Acad. Polon. Sci., Cl. 3, 3, 321 (1955).

Tl^{209}	β^-	70%	1.8 *2*	10^d Ac source	sl
81 128		30%	2.3 *2*		
2.2^m	γ		0.114	$a_K \sim 0.3^*$ E1	scin
			0.50	1.20	
			0.60	1.50	
			1.10	1.60	

$(< 2.3\beta)(0.114\gamma)$

*Source chemically separated from 47^m Bi

L.B.Magnusson, F.Wagner, Jr., D.W. Engelkemeir, M.S.Freedman, ANL-5386 (1955); Phys. Rev. 88, 171A (1952).

γ	0.12	scin
	0.45	
	1.56	

$(0.12\gamma)(0.45\gamma,\ 1.56\gamma)$

I.Perlman, F.Stephens, F.Asaro, Phys. Rev. 98, 262A (1955).

Pb	γ	Pb(n,n'γ)		$E_n = 3.2$	scin
82	0.52†	0.35	0.18†	1.10	
	1.02†	0.52	0.25†	1.4	
	1.05†	0.80	0.16†	2.2	

†σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Pb		Pb(n,n'γ)	$E_n = 4.5$	
82	γ	0.79 *2*		scin
		1.36?		
		2.70 *7*		

G.L.Griffith, Phys. Rev. 98, 579 (1955).

Pb^{197}	τ		42^m *3*	Tl(190-Mev p)	chem; ms
82 115	ϵ				
42^m	γ	> 13*	0.169**		sd ce
		100*	0.223	$K/L \geq 0.4$	$L_1L_2/L_3 = 2.3$
		67*	0.234**	$K/L \sim 0.3$	$L_1L_2/L_3 = 2.0$
		13*	0.323?		
		85*	0.386	$K/L \sim 5$	No L_3
		59*	0.388	$K/L \sim 5$	No L_3

Energy range observed 0.05 to 0.70

*Relative intensity ce_K

**Possibly converted in Pb

G.Andersson, E.Arbman, I.Bergström, A.H.Wapstra, Phil. Mag. 46, 70 (1955).

Pb^{198}	τ		2.3^h *2*	Tl(190-Mev p)	chem; ms
82 116	ϵ				
2.3^h	γ	> 60*	0.173	$K/L \geq 0.5$	$L_1L_2/L_3 = 1.9$
		5*	0.276?		
		100*	0.291		No L_3
			0.330?		
		100*	0.365		
		17*	0.383		
		10*	0.398?		
		8*	0.420?		

No 25^m activity observed

Energy range observed 0.05 to 0.70 sd ce

*Relative intensity ce_K

G.Andersson, E.Arbman, I.Bergström, A.H.Wapstra, Phil. Mag. 46, 70 (1955).

Pb^{199}	τ		90^m *10*	Tl(190-Mev p)		chem; ms
82 117	ϵ					
90^m g.s.	γ	43*	0.354	$K/L \sim 5$	No L_3	sd ce
		100*	0.367	$K/L \sim 5$	No L_3	
		3*	0.722?			

*Relative intensity ce_K

G.Andersson, E.Arbman, I.Bergström, A.H.Wapstra, Phil. Mag. 46, 70 (1955).

Pb^{199}	τ	12.2^m *3*	Tl(190-Mev p)		chem; ms
82 117	γ	0.423	$K/L = 1.9$	M4?	sd ce
12^m					

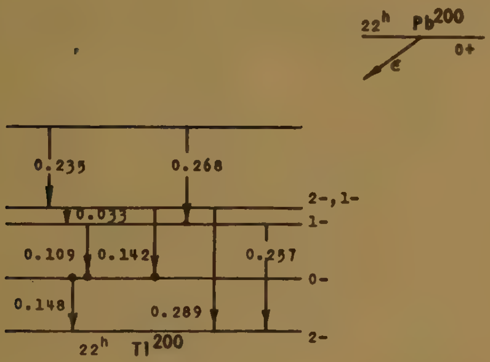
Photon not detected γ converted in Pb

G.Andersson, E.Arbman, I.Bergström, A.H.Wapstra, Phil. Mag. 46, 70 (1955).

Pb^{200}
82 118
22^h

τ		21.5^h 4	Tl(190-Mev p)		chem
γ		0.0328	ce_M, ce_N only		sd ce
	3*	0.1095	K/L	No L_3	M1
	43*	0.1422	4.5	No L_3	M1
	100*	0.1480	0.4	$L_1L_2/L_3 = 1.9$	E2
	4*	0.1589			
	22*	0.2353	5.5	No L_3	M1
	7*	0.2573	4.5	No L_3	M1
	14*	0.2680	4.5	No L_3	M1
	1*	0.2895			
		0.450	*Relative intensity ce_K		

(ce 0.148 γ)(ce 0.109, 0.142, 0.235, 0.268 γ)**
No(ce 0.148 γ)(ce 0.159, 0.257, 0.289 γ)**



K.E.Bergkvist, I.Bergström, C.J.Herrlander, S.Hultberg, H.Slätis, E.Sokolowski, A.H.Wapstra, T.Wiedling, Phil. Mag. 46, 65 (1955); **T.R.Gerholm, ibid.

Pb^{201}
82 119
9.4^h
g.s.

τ 9.4^h 2 Tl(190-Mev p) chem

γ(Tl)	0.1291	K/L				K/L
0.7*	0.2844?			0.6*	0.692	6.5
0.5*	0.3100	0.7?		0.3*	0.708?	
100*	0.3303	4.7		1.0*	0.766	5.5
25*	0.3612	5.6		0.4*	0.825?	
0.6*	0.3943	2.5		1.3*	0.907	5.5
2.7*	0.4056	2.8		1.6*	0.946	6.5
1.9*	0.585	5.5		0.2*	1.099	5.5

(ce 0.330 γ)(ce 0.361 γ)** sl
*Relative intensity ce_K

K.E.Bergkvist, I.Bergström, C.J.Herrlander, S.Hultberg, H.Slätis, E.Sokolowski, A.H.Wapstra, T.Wiedling, Phil. Mag. 46, 65 (1955); **T.R.Gerholm, ibid.

Pb^{201}
82 119
60^s

τ 60^s 4 $Tl^{(203)}$(15-Mev p, 3n)
γ 0.65 3 $\alpha_K \sim 0.8$ scin x/γ

V.K.Fischer, Phys. Rev. 99, 764, 672A (1955).

Pb^{202}
82 120
$\sim 3\times10^{5y}$
g.s.

τ $\sim 3\times10^{5y}$ p 12^dTl chem
$Tl^{(203)}$(21-Mev d,3n)chem, ms
Assumed σ(21-Mev d,3n) = 0.5
(Tl^{202} L x ray)/(Pb^{202} L x ray) = 1.6 implies
$\epsilon_m \sim 40\%$ for Pb^{202}
No K x ray (< 0.5% of Tl^{202} K x ray) scin

J.R.Huizenga, C.M.Stevens, Phys. Rev. 96, 548 (1954).

Pb^{202}
82 120
3.5^h

			α_K	K/L	sd ce
γ(Pb)	2*	0.1294		< 0.003	E4
				$L_2/L_3 = 1.7$	
	35*	0.4219	0.035	2.5	E2
	3.5*	0.6576	0.005	7.5	E1
	100*	0.7869	0.089	1.35	E5
	12*	0.9612	0.006	5.9	E2
ε ~ 10%					
γ(Tl)	27*	0.3892	0.16		M1+E2
	5*	0.4013	0.030		E2
	14*	0.4599		1.5	E3

*Relative intensity ce_K

K.E.Bergkvist, I.Bergström, C.J.Herrlander, S.Hultberg, H.Slätis, E.Sokolowski, A.H.Wapstra, T.Wiedling, Phil. Mag. 46, 65 (1955).

Pb^{203}
82 121
6.7^s

τ 6.7^S 4 $Tl^{(203)}$(15-Mev p,n)
γ 0.86 4 $\alpha_K \sim 0.13$ scin x/γ

V.K.Fischer, Phys. Rev. 99, 764, 672A (1955).

τ $\sim 10^S$ d 12^hBi chem
γ ~0.5? scin
0.9

I.Bergström, A.H.Wapstra, Phil. Mag. 46, 61 (1955).

Pb^{204}
82 122
68^m

γ	(0.375)	E2	99.5%	M3	0.5%
	(0.899)	E2	100%		
	(0.913)	E5	99%	M6	1%

$\left.\begin{array}{l}(0.913\gamma)(0.375\gamma)(\theta)\\(0.913\gamma)(0.899\gamma)(\theta)\end{array}\right\} J = 9, 4, 2, 0$ scin
μ(1.274-Mev level) = 0.22 ± 0.02 γγ(θ,H)

V.E.Krohn, S.Raboy, Phys. Rev. 97, 1017 (1955).

γ	12*	0.8993	E2	sd ce
	100*	0.9130	(E5)	

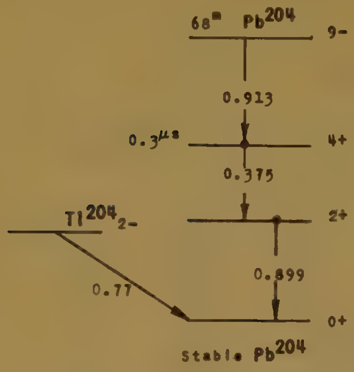
*Relative intensity ce_K

K.E.Bergkvist, I.Bergström, C.J.Herrlander, S.Hultberg, H.Slätis, E.Sokolowski, A.H.Wapstra, T.Wiedling, Phil. Mag. 46, 65 (1955).

Pb^{204}
82 122
68^m

$(0.375\gamma)(0.899\gamma)$ delay $< 6x10^{-10 s}$

A.W.Sunyar, Phys. Rev. 98, 653 (1955).



V.E.Krohn, S.Raboy, Phys. Rev. 97, 1017(1955).

Pb^{205}
82 123
?

τ_{ϵ_K} $> 6x10^{7y}$
τ_{ϵ_L} $\gg 3x10^{5y}$
$Tl^{(205)}$(21-Mev d,2n) chem, ms
No activity observed

J.R.Huizenga, C.M.Stevens, Phys. Rev. 96, 548 (1954).

Pb^{206}
82 124
stable

Level $Pb^{206}(p,p'\gamma)$ $E_p = 5.0$; γ scin
0.81 *1* $\tau = 7.7^{\mu\mu s}$ $(\alpha = 0.01)$

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112, 616A (1955).

Pb^{207}
82 125
0.82^s

τ 0.799^s *13* $Pb^{(208)}(\leq 22$-Mev γ,n)
Indirect production of 0.82^sPb suggested by large threshold (10.2 ± 0.3)

W.L.Bendel, M.E.Toms, R.A.Tobin, Phys. Rev. 99, 672A (1955); verbal report.

τ 0.8^s *1* $Pb^{208}(\leq 23$-Mev γ,n)
γ 0.50 scin
1.01
Threshold of ~9-Mev inferred from activation ratios of Pb to Ag and Cu for $12 \leq E_\gamma \leq 23$

J.M.Reid, K.G.McNeill, Phil. Mag. 45, 957 (1954); Proc. Phys. Soc. 66A, 1179 (1953).

Pb^{207}
82 125
stable

Level $Pb^{207}(p,p'\gamma)$ $E_n = 4.5$; γ scin
0.57 *1* $\tau = 100^{\mu\mu s}$ $(\alpha = 0.021)$

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112, 616A (1955).

Pb^{207}
82 125
stable

$Pb^{(207)}(n,n'\gamma)$ $E_n = 1.4$ to 3.2
Graph of σ for excitation of 0.82^s level given from threshold (1.6) to 3.2 γ scin

P.H.Stelson, E.C.Campbell, Phys. Rev. 97, 1222 (1955).

Level $Pb^{(207)}(d,p)$ $E_d = 15.1$ scin
g.s. $l_n = 1$ $d,p(\theta)$

N.S.Wall, Phys. Rev. 96, 670 (1954).

Pb^{209}
82 127
3.3^h

β^- 0.63 *1* d 10^d Ac chem scin
F-K linear $(E_\beta > 0.38)$
No γ, no x ray scin

L.B.Magnusson, F.Wagner, Jr., D.W. Engelkemeir, M.S.Freedman, ANL-5386 (1955); Phys. Rev. 88, 171A (1952).

Pb^{210}
82 128
19^y

τ 19.40^y *35* differential ic

J.Tobailem, J. phys. radium 16, 235 (1955).

β^- ≥90% 0.017 *2* 4π scin
$\beta(0.047\gamma)$ delay$<3x10^{-9 s}$

G.M.Lewis, Proc. Phys. Soc. 68A, 735 (1955).

Pb^{212}
82 130
10.6^h

τ 10.643^h *12* source addition

J.Tobailem, J.Robert, J. phys. radium 16, 115 (1955).

Bi^{206}
83 123
6.4^d

$\gamma(0.803\gamma)$ delay $<5x10^{-10 s}$

A.W.Sunyar, Phys. Rev. 98, 653 (1955).

Bi^{207}
83 124
8.0^y

$Pb^{(206)}$(10-Mev d,n) chem
τ 8.0^y *6*
Counted for 11 years
Identified with previously known $\sim 50^y Bi^{207}$ from study of γ spectrum

L.T.Cheng, V.C.Ridolfo, M.L.Pool, D.N.Kundu, Phys. Rev. 98, 231A (1955).

			$x\gamma$*	Pb(25-Mev p) chem
γ	157†	0.57	19	scin
	100†	1.07	8	
	≤1.0†	1.46	≤1.5	
	16†	1.76	7	
	0.72†	2.47		

$(0.57\gamma)(1.07\gamma, 1.46\gamma, 1.76\gamma)$
No 2.06γ, 2.20γ, 2.33γ ($<$ 0.14†)
No $(0.57\gamma)\gamma\gamma$ No 0.187γ, 0.87γ
*Percent of photons coincident with K x ray

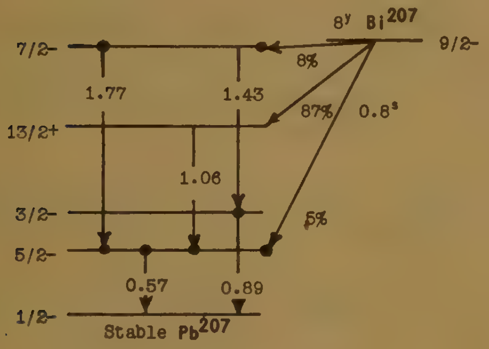
J.R.Prescott, Proc. Phys. Soc. 67A, 540 (1954).

Bi^{207}
83 124
8.0^{y}

				ce$_K$	K/LM	
γ	100†	0.5690	*15*	170*	3.4	sl ce,
	~0.2†	0.894	*7*	0.39*		scin
	88†	1.0639		820*		
	0.2†	1.43	*1*	0.09*		
	9†	1.771	*5*	2.2*	4.4	

$(\alpha_K\ 1.06\gamma)/(\alpha_K\ 0.57\gamma) = 5.98$
No 2.35γ $(< 6\times10^{-4}$†$)$ D(γ,n)
No 0.324γ, 0.704γ, 0.740γ $(ce_K < 0.2^*)$ sl ce
$(0.57\gamma)(1.06\gamma)$ No $(1.06\gamma)(1.77\gamma)$
$(0.89\gamma)(1.43\gamma)/(0.57\gamma)(1.77\gamma) \sim 0.02$
(K x ray) $(0.57\gamma + 1.77\gamma)$/(K x ray) < 0.02
(L x ray) $(0.57\gamma + 1.77\gamma)$
(K x ray) (0.57γ)/K x ray) indicates 5% of
ϵ_K to 0.57 level
(L x ray) (1.77γ) delay $< 3\times10^{-8}$ s
(ce $1.06\gamma)(0.57\gamma)$ delay $< 4\times10^{-10}$ s

*Relative ce$_K$ intensity



D.E.Alburger, A.W.Sunyar, Phys. Rev. 99, 695; 98, 276 (1955).

γ	100†	0.570	scin
	77†	1.07	
	9.2†	1.77*	

$(0.57\gamma)(1.07\gamma,\ 1.77\gamma)$
$(1.77\gamma^*)(0.57\gamma)(\theta)$
J = 7/2, 5/2, 1/2 *E2/M1 = 0.007
or J = 9/2, 5/2, 1/2 *M3/E2 = 0.034
(K x ray)$(0.57\gamma)/(0.57\gamma)$ indicates ϵ_K to
0.57 level in 2.8% disintegrations
No (K x ray)$(1.07\gamma,\ 1.77\gamma)$
No 0.70γ $(<0.5$†$)$ No 1.46γ $(<0.2$†$)$
No γ with $0.10 < E_\gamma < 0.50$

N.H.Lazar, E.D.Klema, Phys. Rev. 98, 710, 1186A (1955).

$\gamma(0.570\gamma)$ delay $< 4\times10^{-10}$s

A.W.Sunyar, Phys. Rev. 98, 653 (1955).

Bi^{209}
83 126
stable?

Levels	Bi^{209}(n,n′)	E$_n$ = 2.5
	1.0	pc
	1.5	
	1.9	

Geneva Conf. 8/P/714 (1955), M.V.Pasechnik (USSR).

γ		Bi^{209}(n,n′γ)	E$_n$ = 3.2	scin
	0.43†	0.49		
	1.2 †	0.94		
	0.59†	1.62		
	0.39†	2.6 ?		

†σ in barns

V.E.Scherrer, B.A.Allison, W.R.Faust, Phys. Rev. 96, 386 (1954).

Bi^{210}
83 127
5.00^{d}

J 1 8

K.F.Smith, quoted by E.A.Plassmann, L.M.Langer Phys. Rev. 96, 1593 (1954).

β^- 1.155 *5* sπ
Spectrum shape can be fitted by S, T
interaction with ΔJ = 1, yes

E.A.Plassmann, L.M.Langer, Phys. Rev. 96, 1593 (1954).

β^- 1.17 sl
No γ $(< 0.01\%)$
Spectrum shape can be fitted by S, T
interaction with ΔJ = 1, yes

L.Lidofsky, N.Benczer, P.Macklin, C.S.Wu, Phys. Rev. 98, 1186A (1955).

Bi^{210}
83 127
2.6x10^{6y}
g.s.

α 4.97 Bi^{209}(n,γ) chem; ic

M.A.Rollier, Gazz. chim. ital. 84, 658 (1954); Chem. Abstr. 49-12983f (1955).

Level Bi^{209}(d,p) E$_d$ = 15.1 scin
d,p(θ) for proton group with Q = 1.94 not in
agreement with simple theory for l_n = 2,4,6

N.S.Wall, Phys. Rev. 96, 670 (1954).

Resonances Bi^{209}(n) E$_n$ = 1 to 55 kev

E$_o$ (kev)	l*	Γ(ev)*	E$_o$
<1			16
2.2	0	<< 100	34
11.8*	0		47

C.T.Hibdon, A.Langsdorf, Jr., Phys. Rev. 98, 223A (1955); *verbal report.

Bi^{212}
83 129
60.5^{m}

γ (0.040) $\alpha = 20^{*}$ M1 $\alpha\gamma/\alpha$
$(6.05\,\alpha)(0.040\,\gamma)(\theta)$ J = 1 or 2, 4, 5
*Using $(6.05\,\alpha)/\alpha = 0.70$

J.W.Weale, Proc. Phys. Soc. 68A, 35 (1955).

$(>0.65\,\gamma)(\leq 1.50\,\gamma)$ scin
$(>0.80\,\gamma)(\leq 1.35\,\gamma)$

F.Demichelis, Nuovo Cim. 12, 407 (1954).

Bi^{213}
83 130
47^{m}

β^{-} 32+ 0.96 *2* 10^{d} Ac source sl
68+ 1.39 *2*
γ 32+* 0.437 K/L = 7 sl ce
$\alpha_K = 0.23^{*}$ scin, x/γ
x 6.7+* K x ray
$(0.96\beta)(0.437\gamma)$ scin
No $(1.39\beta)(E_\gamma > 0.02)$
D 2.2^{m}Tl 2% from $(\mathrm{Tl}^{209}\beta)/(\mathrm{Bi}^{213}\beta)$ sl
*Source chemically separated from 10^{d} Ac

L.B.Magnusson, F.Wagner, Jr., D.W. Engelkemeir, M.S.Freedman, ANL-5386 (1955); Phys. Rev. 88, 171A (1952).

Bi^{214}
83 131
19.7^{m}

β^{-} >5+ 2.56 *25* a $\beta\gamma$
10+ (3.17)
No $(3.17\,\beta)\,\gamma$

R.A.Ricci, G.Trivero, Nuovo Cim. 1, 717 (1955); Rend. Acad. nazl. Lincei 17, 44 (1954).

γ 322+ 1.76 scin
100+ 2.20
48+ 2.42*
*2.48 ± 0.12 photons per 100 disintegrations by comparison with Ra standard

G.Backenstoss, K.Wohlleben, Z.Naturf. 10a, 384 (1955).

$(E_\beta < 1.4)(1.38,\ 1.52,\ 2.2,\ 2.4\gamma)$ scin
$(E_\beta \sim 1.4)(1.12,\ 1.24,\ 1.77\gamma)$
$(E_\beta > 1.4)(0.77,\ 0.93\gamma)$
$(E_\beta > 1.8)(0.607,\ 0.85\gamma)$
No $(E_\beta > 1.8)(0.77\gamma)$

$(0.607\gamma)(0.77, 0.93, 1.12, 1.24, 1.38, 1.52, 1.85\gamma)$
No $\gamma(1.77,\ 2.2,\ 2.4\gamma)$
No $(0.76\gamma)(1.29\gamma)$

R.E.Rowland, Phys. Rev. 99, 757 (1955).

$(0.61\gamma)(1.12\gamma)$ most intense cascade scin
Weak $\gamma\gamma$ for both γ's with $1.3 > E_\gamma > 0.61$
All other $\gamma\gamma$ include 0.61γ
No $(0.61\gamma)(\gamma)$ for $E_\gamma > 1.6$
~ 65% of all γ's belong to a cascade

F.Demichelis, R.Malvano, Nuovo Cim. 12, 358 (1954).

$\mathrm{Po}^{197?}$
84 113

τ $\sim 4^{m}$ Bi^{209}(170-Mev p) chem
α 6.040 s

S.Rosenblum, H.Tyrén, Compt. rend. 239, 1205 (1954).

$\mathrm{Po}^{198?}$
84 114

τ $\sim 6^{m}$ Bi^{209}(170-Mev p) chem
α 5.935 s

S.Rosenblum, H.Tyrén, Compt. rend. 239, 1205 (1954).

$\mathrm{Po}^{199?}$
84 115

τ $\sim 11^{m}$ Bi^{209}(170-Mev p) chem
α 5.846 s

S.Rosenblum, H.Tyrén, Compt. rend. 239, 1205 (1954).

$\mathrm{Po}^{200?}$
84 116

τ $\sim 8^{m}$ Bi^{209}(170-Mev p) chem
α 5.770 s

S.Rosenblum, H.Tyrén, Compt. rend. 239, 1205 (1954).

Po^{201}
84 117
18^{m}

τ $\sim 17^{m}$ Bi^{209}(170-Mev p) chem
α 5.671 s

S.Rosenblum, H.Tyrén, Compt. rend. 239, 1205 (1954).

Po^{202}
84 118
56^{m}

τ $\sim 55^{m}$ Bi^{209}(170-Mev p) chem
α 5.575 s

S.Rosenblum, H.Tyrén, Compt. rend. 239, 1205 (1954).

Po^{204}
84 120
3.8^{h}

τ $\sim 3.8^{h}$ Bi^{209}(170-Mev p) chem
α 5.370 s

S.Rosenblum, H.Tyrén, Compt. rend. 239, 1205 (1954).

Po^{208}
84 124
2.9^{y}

α ~0.1% 4.724 s
~100% (5.109)

S.Rosenblum, H.Tyrén, Compt. rend. 239, 1205 (1954).

Po^{210}
84 126
138.4^{d}

τ 138.4005^{d} *58* calorimeter
Five samples measured during 100-350 days

J.F.Eichelberger, K.C.Jordan, S.R.Orr, J.R.Parks, Phys. Rev. 96, 719 (1954).

Po^{210}
84 126
138.4^d

$\gamma/\alpha = 1.21 \pm 0.06 \times 10^{-5}$ γ scin, α calorimeter

R.W.Hayward, D.D.Hoppes, W.B.Mann, J.Research, Nat. Bur. Standards 54, 47 (1955).

$\gamma/\alpha = 1.20 \pm 0.12 \times 10^{-5}$ scin

O.Rojo, M.A.Hakeem, M.Goodrich, Phys. Rev. 99, 1629A (1955).

Po^{211}
84 127
0.52^s

α 0.53% 6.569 d 7.5^{h}At; s
0.50% 6.895
99% (7.43)
No 6.34 α (<0.02%)

R.W.Hoff, UCRL-2325 (1953).

Po^{212}
84 128
0.30$^{\mu s}$

α 0.019% ~10.5 ppl
Number of particles with range ≤ 352μ (not electrons) found in ppl from ThB source is ~3 per 10^6 Po^{212} α's

M.Ader, J. phys. radium 16, 732 (1955); 15, 583 (1954).

Po^{215}?
84 131
0.018^s

α 4×10^{-6}% ~9.5 ppl

M.Ader, Compt. rend. 240, 2138 (1955).

At^{210}
85 125
8.3^h

α 0.063% 5.355 s
0.053% 5.437
0.054% 5.519
γ 199* 0.0446 sd ce
$L_1L_2 : L_3 : M : N = 100 : 48 : 41 : 10$
33* 0.115 $K : L : MN = 100 : 17 : 14$
56* 0.243 $\alpha_K = 0.11$ E2
$K : L : MN = 100 : 83 : 25$
1.8* 1.189 $K : L = 100 : 21$
$\alpha_K = 4.8 \times 10^{-3}$ E2
0.21* $\left\{\begin{matrix} 1.458 \\ 1.504 \end{matrix}\right\}$ $\alpha_K = 1.2 \times 10^{-3}$ E1
No 0.511 γ (<5%) scin
*Relative intensity ce

R.W.Hoff, UCRL-2325 (1953).

γ(0.047 γ) delay = 1.5×10^{-9s}

A.W.Sunyar, Phys. Rev. 98, 653 (1955); 95, 626A (1954).

At^{211}
85 126
7.5^h

Bi^{209}(38-Mev α,2n) chem
α 5.862 s
ϵ_K/ϵ_L ~7 from K x rays/L x rays = 3.1; scin, pc

R.W.Hoff, UCRL-2325 (1953).

Rn^{218}
86 132
0.019^s

α 7.127 d 20.8^{d}U; scin
γ 0.609 scin

F.Stephens, Jr., F.Asaro, I.Perlman, Phys. Rev. 96, 1568 (1954).

Fr^{221}
87 134
4.8^m

α ~25%* 6.07 *1* 10^d Ac source; scin $\alpha\gamma$
γ 14+ 0.216 K/L = 0.3 sl ce, scin
$\alpha_L = 0.16$ ce_L/γ
(6.07 α)(0.216 γ) scin
+Photons per 100 disintegrations

L.B.Magnusson, F.Wagner, Jr., D.W. Engelkemeir, M.S.Freedman, ANL-5386 (1955);
*F.Hagemann, et al., Phys. Rev. 79, 435 (1950)

Fr^{223}
87 136
21^m

τ 22^m *1* d 22^{y}Ac chem
α ~0.006% 5.34 *8* ppl

J.P.Adloff, Compt. rend. 240, 1421 (1955).

β^- 1.0 *1* d 22^{y}Ac chem sd
W 1.3 *2*
γ 0.045 *7* sd ce
0.230 *20*

T.O.Passell, UCRL-2528 (1954).

Ra^{222}
88 134
38^s

α 6.554 d 20.8^{d}U; scin
γ 0.330 scin
(6.23 α)(0.330 γ)(θ) J = 0, 2, 0

F.Stephens, Jr., F.Asaro, I.Perlman, Phys. Rev. 96, 1568 (1954).

Ra^{223}
88 135
11.7^d

τ 11.68^d *6* pc
Counted over period of 116 days

G.R.Hagee, M.L.Curtis, G.R.Grove, Phys. Rev. 96, 817A (1954).

ce <5* <0.020 ppl
10* 0.020-0.027
56* 0.027-0.092
29* >0.092
*Relative intensity of ce in indicated energy range

B.F.Bayman, M.A.S.Ross, Proc. Phys. Soc. 68A, 110 (1955).

Ra^{225}
88 137
14.8^d

β^- 0.32 *3* d Th^{229} chem
γ 0.0395 *20* $a_L \leq 1$ E1 γ/x

$(0.32\beta)(0.0395\gamma)$ delay $< 2 \times 10^{-9s}$

I.Perlman, F.Stephens, F.Asaro, Phys. Rev. 98, 262A (1955).

β^- 0.32 *1* d Th^{229} chem scin
γ 33+ 0.040 *1* E1 sl ce, scin
$(0.32\beta)(0.040\gamma)$ scin
+Photons per 100 β's

L.B.Magnusson, F.Wagner, Jr., D.W. Engelkemeir, M.S.Freedman, ANL-5386 (1955).

Ra^{226}
88 138
1620^y

γ (0.186) K/LM=0.62 *5* DDl
a^*=0.22 *2*
*Using 5.7% for 4.611α

M.K.Jurić, D.M.Stanojević, Bull. Inst. Nuclear Sci., Boris Kidrich, 5, 15 (1955).

Ac^{225}
89 136
10.0^d

ce 0.084 d Th^{229} chem sl ce
0.092
γ 22+ 0.085 (K x ray ?) scin
x st Fr L x ray ic
$\alpha(0.085\gamma)$ scin
+Photons per 100 disintegrations

L.B.Magnusson, F.Wagner, Jr., D.W. Engelkemeir, M.S.Freedman, ANL-5386 (1955).

Ac^{227}
89 138
22^y

μ +1.1 S
Q −1.7

M.Fred, F.S.Tomkins, W.F.Meggers, Phys. Rev. 98, 1514 (1955).

τ 21.6^y *4* differential ic

J.Tobailem, J. phys. radium 16, 48 (1955).

β^- 100% 0.0455 *10* 4π pc
F-K linear (E_β>0.007)
No 0.037 γ, no ce, no Th L x rays pc

W.Beckmann, E.Huster, Z.Naturf. 10a, 86 (1955).

x 5%* L x ray scin
No 0.037γ (photon observed but assigned to K x ray of La carrier)
Complete conversion of ~0.016γ in 12% of disintegrations suggested
*From (L x ray)/(0.05 γ of Fr^{223} and Th^{227} daughters) = 81

R.Bouchez, A.Michalowicz, M.Riou, J.Teillac, J. phys. radium 16, 344 (1955).

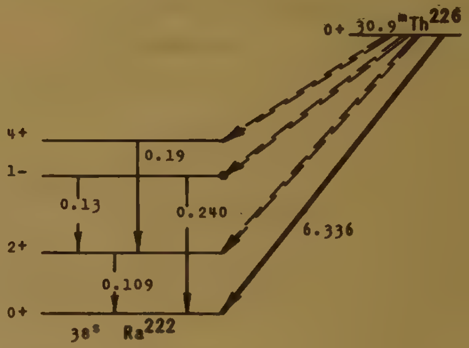
Ac^{228}
89 139
6.13^h

β(L x ray) delay $< 0.2^{\mu s}$

G.Scharff-Goldhaber, E.der Mateosian, G. Harbottle, M.McKeown, Phys. Rev. 99, 180 (1955).

Th^{226}
90 136
30.9^m

α 6.336 d 20.8^dU; scin
γ 0.109 scin
0.13
0.19
0.240
$(6.10\alpha)(0.240\gamma)(\theta)$ J = 0, 1, 0



F.Stephens, Jr., F.Asaro, I.Perlman, Phys. Rev. 96, 1568 (1954).

Th^{227}
90 137
18.2^d

τ 18.17^d *8* pc
Counted over period of 116 days

G.R.Magee, M.L.Curtis, G.R.Grove, Phys. Rev. 96, 817A (1954).

		$L_1 : L_2 : L_3$	
γ	0.02995	3 : 10	a ce
	0.03162	3 : 10	
	0.05013	7 : 8 : 10	a_L<2 E1
	0.06157	9 : 10	
	0.1004	10 : 8	
	0.1133	10 : 7	
	0.1731 ?	(ce$_K$ only observed)	
	0.2050*		
	0.2346*		
	0.2361*		
	0.2564	1.6 : 10 : 4 K/L_2~1.2	
	0.2863*		
	0.3048*		
	0.3128*		
	0.3347*		

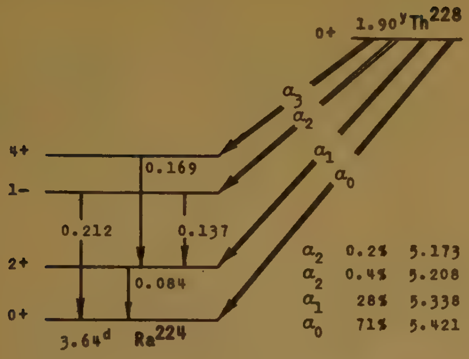
Maximum energy studied = 0.335

*$L_1 >> L_2, L_3$ K/L_1 = 7 to 9.

M.Frilley, S.Rosenblum, M.Valadares, G.Bouissières, J. phys. radium 16, 378 (1955); 15, 45 (1954).

Th^{228}
90 138
1.90^y

(5.21 α)(0.212 γ)(θ) J = 0, 1, 0
(5.34 α)(0.084 γ)(θ) J = 0, 2, 0



F.Stephens, Jr., F.Asaro, I.Perlman, Phys. Rev. 96, 1568 (1954); 92, 1495 (1953).

Th^{230}
90 140
8.0×10^{4y}

α(0.068 γ)(θ)	J = 0, 2, 0	ic, scin
α(0.148 γ)(θ)	J = 0, 4, 2	
α(L x ray)(θ)	Isotropic	

No 0.142 level since α(0.14 γ) shows just one α in coincidence with ~0.14 γ

G.Valladas, J.Teillac, P.Falk-Vairant, P.Benoist, J. phys. radium 16, 125 (1955); Compt. rend. 238, 1409, 1656 (1954).

α(0.25 γ)(θ) J = 0, 1, 0 ic, scin

P.Falk-Vairant, G.Y.Petit, Compt. rend. 240, 286 (1955).

Th^{232}
90 142
1.4×10^{10y}

γ	$Th^{232}(p,p'\gamma)$	$E_p = 5.0$
	0.053 *3*	scin
	0.760 *10* ?	

P.H.Stelson, F.K.McGowan, Phys. Rev. 99, 112 (1955).

Th^{234}
90 144
24.1^d

β^-		~0.10		βγ scin
γ	6.5%	0.029	$\alpha_L = 10^*$	scin
	6.5%	0.064	$\alpha_L = 0.25^*$	
	14.8%	0.093	$\alpha_L = 2.5^*$	

(~0.10 β)(0.029 γ, 0.064 γ, 0.093 γ)
(0.064 γ)(0.029 γ) No (0.093 γ) γ
*Using ce data of Stoker et al.

S.A.E.Johansson, Phys. Rev. 96, 1075 (1954).

p 6.66^hPa 0.63 ± 0.06%
from (1.18^mPa β^-)/(6.66^hPa β^-) GM

W.L.Zijp, Sj. Tom, G.J.Sizoo, Physica 20, 727 (1954).

Pa^{228}
91 137
22^h

γ	0.05748	$L_2/L_3 = 1.0$	E2	sd ce
	0.12864	$L_2/L_3 = 1.3$	E2	

Ong Ping Hok, Phys. Rev. 99, 1613 (1955).

Th^{230}(115-Mev p,3n) chem

		$\underline{L_1} : \underline{L_2} : \underline{L_3}$		sd ce
γ	0.0578 *10*	~0 : 7 : 10	E2	
	0.130 *2*	~0 : 15 : 10	E2	

T.O.Passell, UCRL-2528 (1954).

Pa^{230}
91 139
17.7^d

Th^{232}(50-Mev p,3n) chem

β^-	20%	0.405 *20*	F-K linear ($E_\beta > 0.10$)	
β^+	< 0.03% {	0.2		sd
		0.4		
ε	80%			
γ		0.0528	$L_2/L_3 = 1.2$ E2	sd ce
		0.121		
	70+	0.255		sd ce, scin
	195+	0.445	$K/L_1 = 6.1$	
	W	0.535		
		0.636	$K/L_1 = 1.8$	
		0.712		
	700+	0.953	$K/L_1 = 3.4$	
	105+	1.013		
x	1040+	L x ray		scin
	1140+	K x ray		

All γ's assigned to transitions in Th^{230}
0.239 γ, 0.305 γ assigned to Pa^{233}
1.06 γ, 1.18 γ not observed scin

Ong Ping Hok, P.Kramer, G.Meyer, J.W.R. Fennema, W.L.Zijp, Physica 21, 719 (1955); 20, 77 (1954); Phys. Rev. 99, 1613 (1955).

Th^{232}(100-Mev p,3n) chem

γ		0.0522 *10*	$L_2/L_3 = 1.5$	sd ce
		~0.092		
		0.293 *10*	K/L = 10	
	820+	0.305 *10*	K/L = 5.7	sd ce, scin
	360+	0.460 *15*		scin
	W	0.540 *20*		
	830+	0.940 *20*		
	130+	1.000 *40*		
	140+	1.060 *30*		
	20+	1.180 *40*	?	
x	1800+	L x ray		
	2000+	K x ray		

T.O.Passell, UCRL-2528 (1954).

Pa^{231}
91 140
$34,300^y$

α	0.3%	4.627	27%	(4.938)	s
	1.3%	4.667	28%	5.001	
	10%	4.724	23%	5.018	
	1.5%	4.843	8.7%	5.046	

J.P.Hummel, F.Asaro, I.Perlman, Phys. Rev. 98, 261A (1955).

Pa^{232}			Th^{232}(9-Mev p,n)	chem
91 141	No ϵ_L	(< 2%)	(No Th L x ray)	cryst
1.3^d				

C.I.Browne, Jr., UCRL-1764 (1952).

Pa^{233}	β^-	37%	0.145 *10*		Th^{232}(n,$\gamma\beta$)		chem
91 142		58%	0.257 *5*				sd
27.4^d		5%	0.568 *5*				
						K/L$_1$	
	γ		0.0158	35*	0.3009	6.3	
			0.0275	200*	0.3126	5.0	
			0.0401	18*	0.3408	5.5	
			0.0578	1*	0.3759		
		200*	0.0748	1.5*	0.4003		
		290*	0.0862		0.4167		
			0.1037		0.4756 ?		
			0.2716				sd ce

γ(ce 0.075,0.086,0.104,0.301,0.313,0.341γ) sd

(ce$_K$ 0.086γ)(E$_{ce+\beta}$ = 0.21) sd ce$_K$,a e$^-$

(ce$_K$ 0.313γ)(E$_{ce+\beta}$ = 0.18)

0.425β assigned to Pa^{230}

*Relative intensity ce$_{L1}$

Ong Ping Hok, P.Kramer, Physica, 21, 676 (1955).

			Th^{232}(pile n)	chem
γ	5†	0.02867 *2*		cryst
	4†	0.04047 *10*		
	110†	0.0754 *2*		
	144†	0.0870 *3*		

C.I.Browne, Jr., UCRL-1764 (1952).

Pa^{234}	τ	6.658^h *12*	d 24.1^{d}Th	chem
91 143				
6.66^h				

Background of 24.1^{d}Th ~0.2%

W.L.Zijp, Sj. Tom, G.J.Sizoo, Physica 20, 727 (1954).

γ	< 0.19†	0.250	d 24.1^{d}Th	chem; scin
	0.06†	0.76		
	0.07†	0.91		
	0.02†	1.68		

(0.91 γ)(0.25 γ)/(0.91 γ)(0.76 γ) ~1

†Transitions per 100 Th^{234} disintegrations

S.A.E.Johansson, Phys. Rev. 96, 1075 (1954).

γ	0.0430	L$_2$/L$_3$ = 1.2 E2	sd ce
	0.0992	L$_2$/L$_3$ = 1.3 E2	
	0.1526	L$_2$/L$_3$ = 2.0 E2	

Ong Ping Hok, Phys. Rev. 99, 1613 (1955).

Pa^{234}	β^-		~1.35		$\beta\gamma$	scin
91 143	γ	< 0.19†	0.250	0.00†	(0.81)	scin
1.18^m			0.33 ?	0.37†	1.00	
			0.38 ?	0.04†	1.81	
		0.12†	0.75			

(~1.35 β)(1.00 γ) (~0.6 β)(1.81 γ)

β(0.75 γ)/β(1.00 γ) not f(E$_\beta$) for E$_\beta$ > 0.7

†Photons per 100 Th^{234} disintegrations

S.A.E.Johansson, Phys. Rev. 96, 1075 (1954).

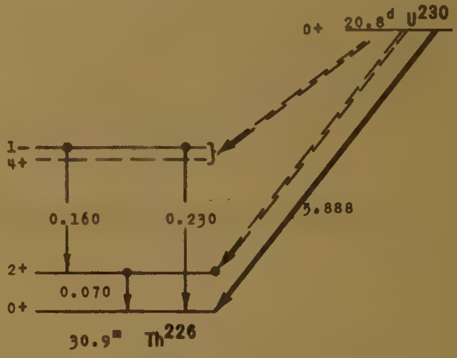
U^{230}	α	5.888	scin
92 138	γ	0.070	scin
20.8^d		0.160	
		0.230	

(5.66 α)(0.160 γ)(θ) Isotropic*

(5.66 α)(0.230 γ)(θ) J = 0, 1, 0

(5.82 α)(0.070 γ)(θ) J = 0, 2, 0

*0.230 level interpreted as 4+, 1- doublet



F.Stephens, Jr., F.Asaro, I.Perlman, Phys. Rev. 96, 1568 (1954).

U^{232}	α	0.32%	5.134	Th^{230}(pile n)		chem; s
92 140		32%	5.261			
74^y		68%	5.318 *2*			
	γ	210+	0.0579 *3*	α = 152	E2	pc
		75+	0.131	$\alpha_K \leq$ 0.4	E2	scin
		4+	0.268			
		4+	0.326			
	x	≤ 30+	K x ray			

α(0.058γ) delay < 10$^{\mu s}$

(0.131γ)(L x ray, 0.058γ)

(0.268γ)(α, L x ray)

+Photons per 10^5 α's

F.Asaro, I.Perlman, Phys. Rev. 99, 37 (1955).

γ	210+	0.060	α_L = 120	E2	scin; x/γ
	107+	0.130	α_K = 0.4	E2	scin; x/γ
	8+	0.270			scin
	6+	0.330			

No 0.190γ (< 5+)

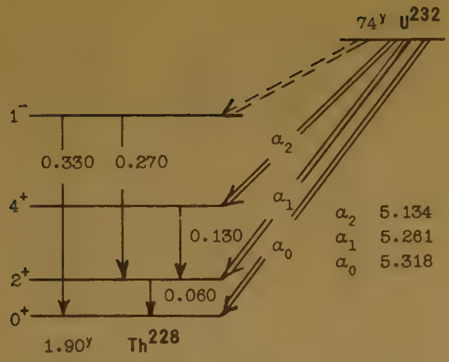
(0.060γ)(0.130γ, 0.270γ)

No (0.060γ)(0.330γ)

α(ce 0.060γ) delay < 0.02$^{\mu s}$ scin

(Continued)

U^{232}
92 140
74^y



G.Scharff-Goldhaber, E.der Mateosian, G. Harbottle, M.McKeown, Phys. Rev. 99, 180 (1955).

U^{234}
92 142
2.5×10^{5y}

Resonances (ev) U^{233} (n)

1.775*
2.30
3.62*
4.76
5.13
6.04
6.79
9.38
10.45
12.8
13.75
15.6
16.4
19.0
20.8
22.3
25.5
28.5
31.1
32.1
34.6
37.1
40.0
40.8
42.5
49.1
54.5
56.7
61.6
65.0
69.4
75.1
79.5
82.6
91.3
98.1

*Breit-Wigner one level fits not possible

Geneva Conf. 8/P/423 (1955), written by J.E. Lynn, N.J.Pattenden (UK). See Appendix.

Resonances U^{233} (n) E_n = 0.01 to 90 ev
mod cyc

1.7 ev
2.25
3.4
4.5
6.25 *40*
10.0 *8*
12.0 *10*
15.0 *14*
21.0 *22*

Geneva Conf. 8/P/646 (1955), S.J.Nikitin et al. (USSR). See Appendix.

Resonance U^{233} (n, f) E_m = 0.005 to 5ev
1.85 *15* ev cryst

J.M.Auclair, P.Hubert, G.Vendryes, J. Nuclear Energy 1, 306 (1955); J. phys. radium 16, No. 7, 50s (1955).

Resonances U^{233} (n, f) E_n = 0.01 to 600 ev
chopper

1.5 ? ev
1.82
2.3
3.7
4.8
6.9
10.7
13.5
16
22 ⎤
35 ⎥ multiple?
[illegible] ⎥
120 ⎦

Resonance at negative energy suggested

Geneva Conf. 8/P/645 (1955), Y.B.Adamchuk et al. (USSR). See Appendix.

U^{235}
92 143
7.1×10^{8y}

J 7/2 8

K.L.Vander Sluis, J.R.McNally, Jr., J. Opt. Soc. Amer. 45, 65 (1955).

U^{236}
92 144
2.4×10^{7y}

Resonances U^{235} (n) E_m = 0.01 to 90 ev
mod cyc

0.3 ev
1.08
1.5 ?
2.0
2.7 ?
3.6
5
6.5
8.7
12
16
19.5
34

Geneva Conf. 8/P/646 (1955), S.J.Nikitin et al. (USSR). See Appendix.

Resonances U^{235} (n); (n, f) 10^{-3} ev

σ_{to}	E_o (ev)	Γ	$2g\Gamma_n$
	-1.4 *2*	210 *30*	
	-0.02	75	
109 *5*	0.290* *5*	128 *5*	0.0031 *2*
117 *6*	1.142 *10*	150 *7*	0.0154 *8*
114 *6*	2.035* *5*	44 *5*	0.0078 *9*
20 *10*	2.86 *7*	90 *40*	0.004 *1*
76 *8*	3.140 *5*	170 *20*	0.031 *3*
188 *9*	3.610 *5*	97 *5*	0.0505 *25*
350 *35*	4.8[illegible] *3*	48 *5*	0.0622 *30*
	5.4 *2*		0.04 *2*
	5.6 *2*		
	6.2 *2*		0.04 *2*
910 *90*	6.3[illegible] *4*	64 *7*	0.287 *30*
360 *130*	7.09 *5*	60 *20*	0.13 *1*
1200 *400*	8.77 *8*	130 *30*	1.08 *9*
	9.27 *10*		0.14 *3*
	9.5 *2* }		0.06 *3*
	9.8 *2* }		
	10.2 *1*		0.09 *2*
900 *300*	11.7 *1*	80 *20*	0.63 *6*
2300 *800*	12.5 *1*	70 *20*	1.54 *12*
	13.3 *3*		0.05 *3*
	14.1 *1*		0.51 *13*
	14.6 *3*		0.19 *6*
	15.4 *2*		0.25 *5*
	16.2 *2*		0.34 *8*
	16.8 *2*		0.25 *8*
	18.2 *2*		0.43 *11*
4100 *1200*	19.3 *2*	80 *20*	4.9 *5*
1800 *70*	21.2 *2*	120 *40*	3.4 *3*
	23.0 *4*		0.3 *2*
600 *300*	23.7 *3*	170 *70*	2.0 *4*
	24.6 *4*		0.5 *1*
	25.7		0.8 *2*
	26.8 *4*		0.64 *13*
	28.0 *4*		0.9 *2*
	31.2 *5*		1.1 *4*
	32.4 *5*		1.9 *3*
	33.9 *7*		5 *2*
2400 *900*	35.3 [illegible]	150 *50*	10 *2*

*Γ_f (measured) = 98 ± 5, 14 ± 5 × 10^{-3} for 0.290, 2.035 resonances resp., hence Γ_γ = 29.5 ± 6.0 × 10^{-3} ev

Fission definitely shown for first 15 res.

Geneva Conf. 8/P/586 (1955), written by V.L.Sailor (USA). See Appendix.

U^{236}
92 144
2.4×10^{7y}

Resonances $U^{235}(n);(n,f)$

	Peak σ_f*	E_o (ev)		Peak σ_f*	E_o (ev)
		0.005	Γ = 0.110 ev		
σ_{to} = 120 *10*		0.30	Γ = 0.140 *30* ev		
		1.12			
		2.05			13.9
		3.1		830	19.0
	108	3.55			24.8
	148	6.3		1310	34
	110	7.0			72
	890	8.75			90
	520	12.2			

*Assuming Γ = 0.150 ev

Geneva Conf. 8/P/423 (1955), written by J.E. Lynn, N.J.Pattenden (UK). See Appendix.

Resonances $U^{(235)}(n,f)$ E_n = 0.01 to 0.4 ev
~-0.7 ev if Γ_f^2~0.3 cryst
~+0.28

D.Popović, J. Nuclear Energy 1, 3, 170 (1954).

Resonances $U^{(235)}(n,f)$ E_n = 0.01 to 900 ev

0.30 ev	6.8 ? chopper
1.13	8.4
1.9 ?	12.0
3.0	18.0
3.5	22 ?
4.8 ?	31 } multiple
6.1	50 } multiple

Resonance at negative energy suggested

Geneva Conf. 8/P/645 (1955), Y.B.Adamchuk, et al. (USSR). See Appendix.

U^{238}
92 146
4.51×10^{9y}

τ 4.507×10^{9y} *9*
From (1503 α's)/(min mg natural U) assuming relative abundances: 99.28, 0.715, 0.0058 and relative α intensities: 1, 0.046, 1 for U^{238}, U^{235}, U^{234} resp.

A.F.Kovarik, N.I.Adams, Phys. Rev. 98, 46 (1955).

U^{239}
92 147
23.5^m

Resonances $U^{238}(n);(n,\gamma);(n,n)$

E_o (ev)	Γ (10^{-3} ev)	Γ_n (10^{-3} ev)
6.67 *4*	27.5 *15*	1.4 *1*
21.0 *3*	37.5 *23*	8.7 *3*
36.8 *2*	53.5 *39*	28.6 *15*
66.2 *4*	41.2 *23*	22.6 *15*
81.1 *5*	25	2
103.3 *7*	83 *4*	67.5 *30*
117.5 *8*	36.8 *45*	23.2 *15*
166 *2*		
191.5 *15*		

Peaks also observed at 146, 210, 240, 275, 292, 320, 350, 410, 536, 595, 616, 670, 710, 770 ev

Geneva Conf. 8/P/423 (1955), written by J.E. Lynn, N.J.Pattenden (UK). See Appendix.

U^{239}
92 147
23.5^m

Resonances $U^{(238)}(n)$ E_n = 5 to 750 ev

σ_o (10^3 b)	E_o (ev)	Γ (10^{-3} ev)	Γ_γ (10^{-3} ev)
31 *6***	20.9 *2*	33 *5*	25 *5*
37 *8***	37.0 *3*	61 *7*	29 *9*
24 *10***	66.5 *7*	44 *10*	17 *10*

E_o (ev)	Γ_n (10^{-3} ev)*	E_o (ev)	Γ_n (10^{-3} ev)*
81.6 *9*	2.1 *7*	212 *5*	60 *30*
90 *2*	0.09 *3*	242 *6*	60 *30*
104 *2*	65 *9*	258 *6*	1.3 *6*
118 *2*	15 *2*	278 *7*	40 *20*
146 *3*	0.9 *4*	297 *8*	40 *20*
166 *3*	2.4 *12*	368 *9*	130 *50*
192 *4*	130 *20*	418 *10*	80 *50*

*Based on $\overline{\Gamma}_\gamma$ = 0.025 ± 0.005 ev chopper
Results corrected for presence of U^{235}
Additional resonances with E_o > 200 ev?

J.A.Harvey, D.J.Hughes, R.S.Carter, V.E. Pilcher, Phys. Rev. 99, 10; 98, 1161A (1955).
**Verbal report.

Np^{234}
93 141
4.4^d

U^{235}(21-Mev d,3n) chem
τ 4.4^d *1*
β^+ ~0.8 a, trochoid s
$\beta^+/\epsilon = 5\times10^{-4}$

R.J.Prestwood, H.L.Smith, C.I.Brown, D.C. Hoffman, Phys. Rev. 98, 1324 (1955).

U^{235}(19-Mev d,3n) chem scin

γ	50†	$\left\{\begin{matrix}(0.76)\\(0.81)\end{matrix}\right\}$ unresolved
	40†	1.57
	100†	K x ray
	70†	L x ray

ϵ_K/ϵ_L ~ 1.0

R.W.Hoff, UCRL-2325 (1953).

Np^{235}
93 142
410^d

No γ observed

R.W.Hoff, S.G.Thompson, Phys. Rev. 96, 1350 (1954).

Np^{236}
93 143
$>5000^y$

U^{238}(21.6-Mev d,4n) chem ms
τ_β $>5000^y$
$\sigma(n,f) = 2800$
No α's observed other than Np^{237} α's lc

M.H.Studier, J.E.Gindler, C.M.Stevens, Phys. Rev. 97, 88 (1955).

Np^{236}
93 143
22^h

U^{235}(12.5-Mev d,n) chem
β^- 0.53 *3* sd
γ 0.0435 *10* sd ce
0.0442 *10*

T.O.Passell, UCRL-2528 (1954).

Np^{236}
93 143
22^h

U^{235}(12-Mev d,n) chem
$\epsilon_K/\beta^- = 43/57$ from (K x ray)/(Pu^{236} α)
No 0.150 γ scin

H.Jaffe, UCRL-2537 (1954).

Np^{237}
93 144
2.2×10^6 y

g for 0.060 level = +1.4 ±0.2 $\alpha\gamma(\theta,H)$

V.E.Krohn, T.B.Novey, S.Raboy, Phys. Rev. 98 1187A (1955); verbal report.

Np^{238}
93 145
2.1^d

β^-		~0.27	$Np^{237}(n,\gamma)$	chem; sl
		1.25	F-K linear	
γ		0.0440	$L_2/L_3 = 1.3$	sd ce
		0.1022		
	4*	0.927		
	7*	0.942		
	20*	0.986	K/L = 3.3	
	20*	1.029	K/L = 5.0	

$(0.986\gamma)/(1.029\gamma) = 0.83$ sd pe
No 0.884γ ($ce_K < 2$*)
*ce_K per 10^4 β's

J.O.Rasmussen, H.Slätis, T.O.Passell, Phys. Rev. 99, 42; 98, 261A (1955).

No ϵ_K (< 1%) from (K x ray)/(hard γ) = 0.038
(L x ray, 0.10γ)(~0.93γ)
All 1.25β to 0.044 level β(L x ray) scin
36% of hard γ's to g.s. (L x ray)(hard γ)
(0.10γ)(hard γ)/(0.10γ)(~0.90ce) < 0.8 scin

J.O.Rasmussen, F.S.Stephens, D.Strominger, B.Aström, Phys. Rev. 99, 47; 98, 261A (1955).

No U L_1 x ray (< 4%) cryst

H.Jaffe, UCRL-2537 (1954).

Resonances	Np^{237}(n)	E_n = 0.02 to 3 ev	
	0.489 ev	σ_0 = 2600	Γ = 0.032
	1.34	$\sigma_0\Gamma$ ~ 29	cryst
	1.49	$\sigma_0\Gamma$ ~ 140	

W.S.Smith, R.R.Smith, E.G.Jokl, J.E.Evans, Phys. Rev. 99, 611A (1955).

Resonances	Np^{237}(n)	E_n = 0.008 to 10 ev
	0.5 ev	chopper
	1.5	
	4	

Resonance at negative energy suggested

Geneva Conf. 8/P/645 (1955), Y.B.Adamchuk et al. (USSR). See Appendix.

Np^{239}
93 146
2.33^d

J 1/2 S

J.G.Conway, R.D.McLaughlin, Phys. Rev. 96, 541 (1954).

β^-	~20%	0.343 *15*	scin $\beta\gamma$ delay
γ	89%	0.105 γ + K x ray	

(0.34β) γ delay = $0.193^{\mu s}$
No γ precedes $0.193^{\mu s}$ delay $\gamma\gamma$ delay
Decay scheme proposed

D.Engelkemeir, L.B.Magnusson, Phys. Rev. 99, 135 (1955).

$U^{(238)}$(pile n) chem

γ	5†	0.0576 *3*	cryst
	25†	0.0618 *3*	

H.Jaffe, UCRL-2537 (1954).

Pu^{234}
94 140
9^h

No γ (< 0.5%) U^{233} (36-Mev α,3n); scin

R.W.Hoff, UCRL-2325 (1953).

Pu^{237}
94 143
40^d

τ		40^d	U^{235}(36-Mev α,2n)	chem
			Np^{237}(9.5-Mev p,n)	chem
γ	39†	~0.064	(α_L ~1.1)	scin
x	100†	K x ray		
	77†	L x ray		

ϵ(0.060 level)/ϵ(g.s.) = 0.56

R.W.Hoff, UCRL-2325 (1953).

Pu^{238}
94 144
90^y

γ	0.0436 *3*	$L_2, L_3 > L_1$* $\tau < 5 \times 10^{-10}$ s	E2	s ce
	0.1000 *4*	$L_2, L_3 > L_1$*	E2	

E.L.Church, A.W.Sunyar, Phys. Rev. 98, 1186A (1955); *verbal report.

γ (0.0438) α_{L_2} = 420* cryst
α_{L_3} = 170*
*Using (3.6×10^{-4} 0.0438 photons)/α

H.Jaffe, UCRL- 2537 (1954).

Pu^{240}
94 146
6580^y

γ 0.043 *3* sd ce

T.O.Passell, UCRL-2528 (1954).

Pu^{240}
94 146
6580^{y}

Resonances $Pu^{239}(n)$

$\sigma_{to}\Gamma^{2*}$	E_o(ev)	$\sigma_{to}\Gamma^{2*}$	E_o(ev)	
27.5	−0.23		15.3	$\sigma_{to}\Gamma \sim 24$
51.4**	0.298	~ 10	17.6	
~ 12	7.82		18.7	$\sigma_{to}\Gamma \sim 41$
28	11.0	~ 10	22.2	
10	11.9		23.6 ?	
4.5	14.3	~ 7	26.4	
13	14.7		27.3 ?	

Peaks also observed at 57, 65, 75. 85 ev

*Corrected assuming $\Gamma = 0.05$
**$\sigma_{to} = 5360$, $\Gamma = 0.098$ ev

Geneva Conf. 8/P/589 (1955), written by B.R. Leonard, Jr. (USA). See Appendix.

Resonances $Pu^{239}(n)$ $E_n = 0.01 - 100$ ev

E_o (ev)	$\sigma_{to}\Gamma^2$	mod cyc
0.295 *5*	40 *5*	
8.1 *2*	12 *2*	
11.3 *2*	29 *8*	
12.3 *3*	9 *3*	
15.1 *4*	69 *15*	
18.3 *6*	24 *7*	
22.8 *8*	13 *4*	

Unresolved peaks: 27.6, 43, 52, 59, 66, 84, 96 ev

Geneva Conf. 8/P/646 (1955), S.J. Nikitin et al. (USSR). See Appendix.

Resonance $Pu^{239}(n,f)$ $E_n = 0.008$ to 10 ev
0.298 *2* ev $\Gamma = 0.08$ev
σ suggests negative energy resonance also

M. Galula, B. Jacrot, F. Netter, Compt. rend. 239, 1128 (1954).

Resonances $Pu^{239}(n,f)$ $E_n = 0.01$ to 20 ev
0.300 *5* ev $\Gamma = 0.09$ev cryst
~16

G. Vendryes, P. Hubert, J.M. Auclair, Compt rend. 239, 1034 (1954); J. phys. radium 16, No. 7, 50s (1955); J. Nuclear Energy 1, 306 (1955).

Resonance $Pu^{239}(n,f)$ $E_n = 0.005$ to 1 ev

$\sigma_{fo}\Gamma^2$	E_o(ev)		cryst
14.3	-0.19		
33.2	0.299 *1*	$\sigma_{fo} = 3190$ *50* $\Gamma = 0.102$ *4*	

Geneva Conf. 8/P/589 (1955), written by B.R. Leonard, Jr. (USA). See Appendix.

Pu^{240}
94 146
6580^{y}

Resonances $Pu^{239}(n); (n,f)$

σ_{to}	E_o(ev)	$\Gamma(10^{-3}$ev)	$\sigma_{fo}\Gamma$
5310* 150	0.297	100 *5*	$\sigma_{fo} = 2940$
5000 700	7.85	67 *10*	72
3000 900	10.95	130 *40*	175
2000 600	11.95	90 *30*	
800	14.30	~70	
7000	14.75	~40	150
	~15.5		
~1200	17.75	~150	75
~4000	22.35	~60	105
	26.4		50
*Peak σ	32.5		

Geneva Conf. 8/P/422 (1955), written by J.F. Raffle, B.T. Price (UK). See Appendix.

Resonances $Pu^{239}(n,f)$ $E_n = 0.01$ to 1000 ev

$\sigma_{fo} = 2950$	0.295 ev	$\Gamma = 0.091$	chopper
	7.4		
	10.2	20	
	13.7	55	

Resonance at negative energy suggested

Geneva Conf. 8/P/645 (1955), Y.B. Adamchuk et al. (USSR). See Appendix.

Pu^{241}
94 147
13^{y}

β^- 0.0205 *10* sd

T.O. Passel, UCRL-2528 (1954).

Resonance $Pu^{240}(n)$
$\sigma_{to} \sim 135,000$ 1.058 ev $\Gamma = 0.029$ *3*

Geneva Conf. 8/P/422 (1955), written by J.F. Raffle, B.T. Price (UK). See Appendix.

Resonance $Pu^{240}(n)$ $E_n = 0.8$ to 1.3 ev
$\sigma_{to} = 200,000$ 1.06 *1* ev $\Gamma \sim 0.042$

Geneva Conf. 8/P/589 (1955), written by B.R. Leonard, Jr. (USA). See Appendix.

Pu^{242}
94 148
$\sim 5 \times 10^{5}$y

Resonances $Pu^{241}(n,f)$

$\sigma_{fo} = 1420$ *150*	0.255 *20* ev	$\Gamma = 0.103$ *20*
	4.55 *10*	
	5.8	7.1
	6.3	10 ?

Geneva Conf. 8/P/422 (1955), written by J.F. Raffle, B.T. Price (UK). See Appendix.

Resonances $Pu^{241}(n,f)$ $E_n = 0.01$ to 800 ev
$\sigma_{fo} = 1450$ 0.295 ev $\Gamma = 0.13$ chopper
Additional peaks at 4.8, 6.5, 10, 18, 32, 100 ev

Geneva Conf. 8/P/645 (1955), Y.B. Adamchuk et al. (USSR). See Appendix.

Pu^{244}
94 150
7×10^{7y}

τ_{α} 7×10^{7y} *2* $Pu^{243}(n,\gamma)$

Geneva Conf. 8/P/809 (1955), W.C.Bentley et al. (USA). See Appendix.

Pu^{245}
94 151
10.1^{h}

τ 10.1^{h} *4* Pu^{244}(pile n,γ)
p 2.0^{h} Am chem

Geneva Conf. 8/P/809 (1955), W.C.Bentley et al. (USA). See Appendix.

Am^{240}
95 145
47^{h}

τ		47^{h} *2*	
γ	14†	0.92 *3*	scin
	70†	1.02 *2*	
	15†	1.40 *3*	

R.A.Glass, UCRL-2560 (1954).

Am^{241}
95 146
470^{y}

γ	$L_1L_2^*$	L_3^*	M^*	N^*
0.0265			~1.6	~0.7
0.0326			3.2	1.6
0.0428	5.0	3.1	4.5	~0.9
0.0554	~0.4		~0.3	
0.0592	22	3.5	10	

(ce 0.043γ)(0.026γ) delay = 6×10^{-8} s sl ce
(ce 0.043γ)(0.059γ) delay = 6×10^{-8} s
(ce 0.026γ)(0.033γ) delay $\leq 4 \times 10^{-9}$ s
(ce 0.055γ)(ce 0.043γ, ce 0.059γ)
No ce 0.098γ ($<0.5^*$)
No (ce 0.033γ)(ce 0.059γ)

*ce/100 α's

J.F.Turner, Phil. Mag. 46, 687 (1955).

γ	400†	0.02638 *4*		cryst, sd ce
			$\alpha < 5.5$ E1	
	<100†	0.0332 *1*		sd ce
	<100†	0.0434 *2*		sd ce
		0.056		sd ce_{L_3}
	(4000†)	0.05962 *6*		cryst, sd ce
			$\alpha = 0.9$ $\alpha_L = 0.7$	
			L_1L_2/L_3 ~4.4 E1?	
	6†	0.0995 *10*		scin, sd ce
			L_2/L_3 ~1.7 E2	
	0.6†	0.128		scin
γ	vw	0.168 ?		scin
	vw	0.207 ?		scin

(0.0596γ)(0.0995γ)*
†Photons per 10^4 α's

M.Jaffe, T.O.Passell, C.I.Browne, I.Perlman, Phys. Rev. 97, 142 (1955); *F.S.Stephens, Jr., Ibid.

Am^{241}
95 146
470^{y}

γ	330†	0.02636 *1*			cryst
	20†	0.03320 *2*			
	24†	0.04346 *9*			
	(4000†)	0.05957 *2*			
	4†	0.103 *2*	0.08†	0.210 *5*	scin
	0.3†	0.113 *5*	0.01†	0.270 *10*	
	0.5†	0.130 *4*	0.03†	0.328 *10*	
	0.04†	0.159 *10*	0.02†	0.370 *10*	

No 0.056γ, 0.070γ, (<1†) cryst
†Photons per 10^4 α's

P.P.Day, Phys. Rev. 97, 689 (1955).

γ (0.060) dipole $\alpha,\gamma(\theta)$

T.B.Novey, Phys. Rev. 96, 547 (1954).

No 5.546 α s

F.Asaro, I.Perlman, Phys. Rev. 93, 1423 (1954).

Am^{242}
95 147
100^{y}
g.s.

β^- 0.585 *10* Am^{241}(pile n,γ); sd
0.041γ not observed sd ce

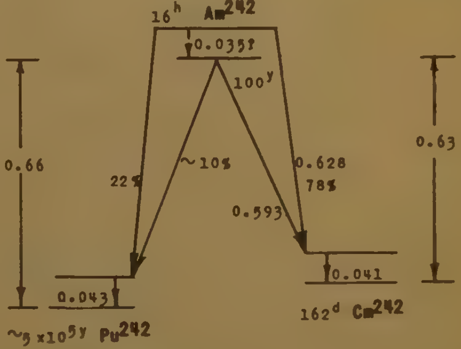
T.O.Passell, UCRL-2528 (1954).

ϵ_K ~10% Am^{241}(pile n,γ)

M.Jaffe, UCRL-2537 (1954).

Am^{242}
95 147
16.0^{h}

β^- 0.628 Am^{241}(pile n,γ); sd
γ 0.041 *2* $\alpha_L > 200$ cryst, sd ce
$L_2 : L_3 : M_2 : M_3 : N = 100 : 74 : 67 : 44 : < 22$
0.043 *2* $\alpha_L > 200$
$L_2 : L_3 = 59 : 23$
IT $< 5\%$ from L x ray intensities cryst
$\beta^-/\epsilon = 3.6$ from L x ray intensities
ϵ_K/ϵ_L ~0.7 scin, cryst



R.W.Hoff, UCRL-2325 (1953).

Am^{242}
95 147
16.0^h

β^- ~70% 0.620 *10* Am^{241}(pilé n,γ); sd
ϵ ~20%
γ^* 0.041 *2* L_2/L_3 = 1.4 E2 sd ce
0.043 *2* L_2/L_3 = 1.4 E2
*Recalculated data of Hoff, UCRL-2325

T.O.Passell, UCRL-2528 (1954).

Am^{241}(pile n,γ) chem
γ 7† 0.0423 *2* α_L = 500 cryst
6† 0.0448 *2* α_L = 200
IT ≤6% (from L x ray intensities)

H.Jaffe, UCRL-2537 (1954).

Resonances	Am^{241}(n)	E_n = 0.006 to 80 ev
	0.3	2.4
	0.53	4
	0.58	5.5 multiple?
	1.26	10
	1.9	17

Geneva Conf. 8/P/645 (1955), Y.B.Adamchuk et al. (USSR). See Appendix.

Am^{243}
95 148
8800^y

α 1.1% 5.169 s
11.5% 5.224
87.1% 5.267
0.16% 5.309
0.17% 5.340
(5.267α)(0.075γ)(θ) J = 5/2, 3/2, 1/2

F.Stephens, J. Hummel, F.Asaro, I.Perlman, Phys. Rev. 98, 261A (1955).

Am^{245}
95 150
1.98^h

τ 1.98^h *2* d 10^{h}Pu chem

Geneva Conf. 8/P/809 (1955), W.C.Bentley et al. (USA). See Appendix.

Cm^{241}
96 145
35^d

Pu^{239}(27-Mev α, 2n) chem
α 5.95 *2* lc
γ w 0.065 ? 28† 0.47 *1* scin
w 0.163 ? 7† 0.59 *1*
α/ϵ = 0.007 from Am^{241} growth and α counts

†Photons per 100 disintegrations

R.A.Glass, UCRL-2560 (1954).

Cm^{242}
96 146
162^d

$\underline{L_1}$: $\underline{L_2}$: $\underline{L_3}$ sd ce
γ 0.0441 *5* ~0 : 1.4 : 1
0.1020 *10* ~0 : ~1 : ~1

T.O.Passell, UCRL-2528 (1954).

Bk^{243}
97 146
4.5^h

τ 4.5^h *1* Cm^{242}(16-Mev d,n) chem
α ~0.15%
γ 0.07 scin
0.22
Higher energy γ's observed
All γ's may belong to Bk^{244}

E.K.Hulet, UCRL-2283 (1953).

Bk^{244}
97 147
~4.5^h

τ ~4.5^h Am^{241}(33-Mev α,n) chem
γ 0.07 scin
0.22
Higher energy γ's observed
All γ's may belong to Bk^{243}

E.K.Hulet, UCRL-2283 (1953).

Bk^{249}
97 152
290^d

τ 290^d *20* Pu(pile n) chem
α ~10^{-3}% 5.40 *5* lc
β^- 0.08 *2* a
τ for spontaneous fission ≥ 2×10^{8y}

L.B.Magnusson, M.H.Studier, P.R.Fields, C.M.Stevens, J.F.Mech, A.M.Friedman, H.Diamond J.R.Huizenga, Phys. Rev. 96, 1576 (1954); 94, 1083 (1954).

Cf^{246}
98 148
1.5^d

τ for spontaneous fission = 2.1×10^{3y}

E.K.Hulet, UCRL-2283; quoted by P.R.Fields, et al. Nature 174, 265 (1954).

α 22% 6.711 Cm(40-Mev α)chem; s
78% 6.753
γ ~0.044 α = 1000 scin
0.014† 0.103 scin
α(L x ray, 0.042 γ, 0.103 γ)
†Photons/100 α's

J.P.Hummel, F.S.Stephens, Jr., F.Asaro, A.Chetham-Strode, I.Perlman, Phys. Rev. 98, 22 (1955).

γ ~0.043 α(ce) ppl

D.C.Dunlavey, G.T.Seaborg, quoted by R.W.Hoff, UCRL-2325 (1953).

Cf^{249}
98 151
~470^y

τ 470^y *100* d 290^{d}Bk chem, ms
α 5.81 *3* lc
No other α (< 5% of 5.81 α)
τ for spontaneous fission ≥ 5×10^{6y}

L.B.Magnusson, M.H.Studier, P.R.Fields, C.M.Stevens, J.F.Mech, A.M.Friedman, H.Diamond, J.R.Huizenga, Phys. Rev. 96, 1576 (1954); 94, 1083 (1954).

Cf^{250}
98 152
10^y
τ 10.0^y *2.4* Bk^{249}(pile n) chem, ms
α 10% 5.99 *1* ic
90% 6.03 *1*
(5.99 α)(L x ray) No (6.03 α)(L x ray)
τ for spontaneous fission $\sim 1.5\times10^{4\,y}$

L.B.Magnusson, M.H.Studier, P.R.Fields, C.M.Stevens, J.F.Mech, A.M.Friedman, H.Diamond J.R.Huizenga, Phys. Rev. 96, 1576 (1954); 94, 1083 (1954).

Cf^{251}
98 153
$>18^d$
τ_β $>> 18^d$ Pu(pile n) chem, ms
No α's observed ic

L.B.Magnusson, M.H.Studier, P.R.Fields, C.M.Stevens, J.F.Mech, A.M.Friedman, H.Diamond J.R.Huizenga, Phys. Rev. 96, 1576 (1954).

Cf^{252}
98 154
2.2^y
τ 2.2^y *2* Pu(pile n) chem, ms
α 10† 6.08 *1*
90† 6.12 *1*
(6.08 α)(L x ray) No (6.12 α)(L x ray)
τ for spontaneous fission $\sim 66^y$

L.B.Magnusson, M.H.Studier, P.R.Fields, C.M.Stevens, J.F.Mech, A.M.Friedman, H.Diamond, J.R.Huizenga, Phys. Rev. 96, 1576 (1954); 94, 1083 (1954).

Cf^{253}
98 155
18^d
τ 18^d *3* Pu(pile n) chem
β^- D 19^d99

L.B.Magnusson, M.H.Studier, P.R.Fields, C.M.Stevens, J.F.Mech, A.M.Friedman, H.Diamond, J.R.Huizenga, Phys. Rev. 96, 1576 (1954); 94, 1083 (1954).

Cf^{254}
98 156
85^d
τ 85^d *15* d $36^h E^{254}$
Decays by spontaneous fission

B.G.Harvey, S.G.Thompson, G.R.Choppin, A.Ghiorso, Phys. Rev. 99, 337 (1955).

Cf^{254}
98 156
85^d
τ 60^d *10* d $36^h E^{254}$
Decays by spontaneous fission

Geneva Conf. 8/P/809 (1955), W.C.Bentley et al. (USA). See Appendix.

E^{254}
99 155
36^h
$\epsilon/\beta^- = 0.001^*$ $E^{253}(n,\gamma)$ chem
*From yield of 85^d Cf

B.G.Harvey, S.G.Thompson, G.R.Choppin, A.Ghiorso, Phys. Rev. 99, 337 (1955).

E^{254}
99 155
$>2^y$
g.s.
τ $>2^y$ $E^{253}(n,\gamma)$ chem
α 6.44 *1* ic
p 3^hBk recoil
Not p 3.2^hFm (< 1%) (7.2α not observed)

B.G.Harvey, S.G.Thompson, G.R.Choppin, A.Ghiorso, Phys. Rev. 99, 337 (1955).

Fm^{254}
100 154
3.2^h
α 15% (7.18) α x/α
γ 0.02+ 0.042 *4* α = 750 scin
0.028+ 0.094 *2*
α(L x ray, 0.042 γ) d $36^h E^{254}$
+Photons/100 α's

F.Asaro, F.S.Stephens, Jr., S.G.Thompson, I.Perlman, Phys. Rev. 98, 19, 260A (1955).

Fm^{256}
100 156
$\sim 4^h$
E^{255}(pile n,$\gamma\beta$) chem
τ for spontaneous fission 3 to 4 hours

G.R.Choppin, B.G.Harvey, S.G.Thompson, A.Ghiorso, Phys. Rev. 98, 1519 (1955).

Mv^{256}
101 155
$\sim 0.5^h$
τ $\sim 0.5^h$ E^{253}(41-Mev α,n) chem
No α

A.Ghiorso, B.G.Harvey, G.R.Choppin, S.G. Thompson, G.T.Seaborg, Phys. Rev. 98, 1518 (1955).

APPENDIX: GENEVA CONFERENCE REPORTS

In many Geneva reports only the "best value" adopted for a quantity by a given laboratory was reported together with a brief summary of the work of the many groups which contributed to it. This made it difficult to give a reference in the usual way. It was finally decided to give with the usual reference only the name of the first author or of the writers of the report and to list all other authors or contributors to the work in the following appendix.

422 Written by: J.F.Raffle, B.T.Price.
Work done by: P.A.Egelstaff, D.B.Gayther, J.E. Lynn, K.P.Nicholson, N.J.Pattenden, B.T.Price, E.R.Rae, J.F.Raffle, R.Richmond, J.E.Sanders, E.R.Wiblin.

423 Written by: J.E.Lynn, N.J.Pattenden.
Work done by: E.R.Collins, V.S.Crocker, P.A. Egelstaff, J.E.Lynn, N.J.Pattenden, B.T.Price, E.R.Rae, J.F.Raffle, R.Richmond, J.E.Sanders, V.G.Small, B.T.Taylor.

586 Written by: V.L.Sailor.
Work done by: H.L.Foote, Jr., W.J.Friesen, E.R. Gaerttner, J.A.Harvey, W.W.Havens, Jr., D.J. Hughes, H.H.Landon, B.R.Leonard, M.Levin, E. Melkonian, V.Perez-Mendez, V.E.Pilcher, L.J. Rainwater, V.L.Sailor, E.J.Seppi, M.L.Yeater.

589 Written by: B.R.Leonard, Jr.
Work done by: E.E.Anderson, L.M.Bollinger, R.E. Coté, W.J.Friesen, S.P.Harris, W.W.Havens, Jr., C.T.Hibdon, A.S.Langsdorf, Jr., L.S.Lavatelli, J.M.LeBlanc, B.R.Leonard, Jr., M.Levin, B.D. McDaniel, E.Melkonian, L.J.Rainwater, E.J.Seppi, R.B.Sutton.

591 Written by: S.Bernstein, E.C.Smith.
Work done by: R.M.Adams, L.B.Borst, N.Elliott, M.S.Freedman, J.Goett, H.Jones, J.D.Knight, P.W. Levy, A.N.May, E.Meiners, C.D.Moak, P.Morrison, L.W.Nordheim, T.B.Novey, L.A.Pardue, S.Raynor, E.Shapiro, L.Slotin, H.Soodak, L.B.Stang, Jr., N. Sugarman, E.O.Wollan, W.H.Zinn.

644 G.M.Kukavadse, L.L.Goldin, M.P.Anikina, B.W. Ershler.

645 Y.B.Adamchuk, V.F.Gerasimov, B.V.Yefimov, V.S. Zenkevich, V.I.Mostovoi, M.I.Pevzner, A.A. Chernyshov, A.P.Tsitovich.

646 S.J.Nikitin, N.D.Galanina, K.G.Ignatiew, W.W. Okorokow, S.I.Suchorutchkin.

650 P.E.Spivac, A.N.Sosnovsky, A.Y.Prokofiev, V.S. Sokolov.

651 L.V.Groshev, B.P.Adyasevich, A.M.Demidov,

714 M.V.Pasechnik.

732 J.Halperin, R.W.Stoughton, I.E.Ferguson, C.V. Ellison, D.C.Overholt, C.M.Stevens.

809 W.C.Bentley, H.Diamond, P.R.Fields, A.M.Friedman, J.E.Gindler, D.C.Hess, J.R.Huizenga, M.G.Inghram, A.H.Jaffey, L.B.Magnusson, W.M.Manning, J.F.Mech, G.L.Pyle, R.Sjoblom, C.M.Stevens, M.H.Studier.

832 Written by: J.A.Harvey.
Work done by: R.S.Carter, J.A.Harvey, W.W.Havens, Jr., D.J.Hughes, B.R.Leonard, Jr., M.Levin, E. Melkonian, G.R.Ringo, S.Wexler.

897 M.D. de Souza Santos, J.Goldemberg, R.R.Pieroni, E.Silva, O.A.Borello, S.S.Villaca, J.Leite Lopes.

2. NEUTRON CROSS SECTIONS

In all cases where cross sections have been measured with monoenergetic neutrons the neutron energy is given in the energy column. Measurements made in a neutron flux with a thermal or pile energy distribution are designated by "th" or "pile" in the energy column.

Slow neutron cross sections are usually measured in a polyenergetic neutron flux by means of comparison with standards known to have thermal absorption cross sections with 1/v energy dependence, where v is the neutron velocity. Such measurements give $\overline{\sigma v}$(sample) = k$\overline{\sigma v}$(standard) = k σ_a(standard) × 2200 where σ_a(standard) is the value for neutron velocity of 2200 m/sec or neutron energy of 0.0253 ev. It is customary to give k σ_a(standard) as the measured cross section of the sample. If the sample cross section has a 1/v dependence (which should be the case if there are no resonances near thermal energies) then this value will be its cross section at 0.0253 ev. Otherwise it is equal to $\overline{\sigma v}$(sample)/2200.

When the authors state the value of the standard σ_a used, it is given with the reference.

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
H	th	a	0.335	mean life	55C42
	th	a	0.333 *3*	mean life	54V10
	91	el(θ)	graph	p scin	54S39
	93 to 107	t	table		55C40
	105	el(θ)	graph	BF$_3$	55T17
	137	el(θ)	graph	BF$_3$	55T17
H^2	0.08 to 0.20	el(θ)	graph	pc	55A17
	0.20	el	3.07	pc	55A17
	0.2 to 22	t	table	n scin	55S61
	93 to 107	t	table		55C40
	109 to 169	t	table		55A24
He	14.3	el	graph	cc	55S08
Li^6	0.035 to 4.2	t	graph		54J17
$\mathrm{Li}^{(7)}$	0.5 to 1.7	n,n′ + 0.48γ	graph	γ scin	55F10
Be	4.0	t-el	0.62 *5*	sphere	55B08
	4.1	el(θ)	graph	n scin	55W27
	4.1	t	1.96	n scin	55W27
	4.1	t-$\int$el(θ)	0.6 *1*	n scin	55W27
Be^7	th	n,p	5.3×10^4 *8*	ic	55H34
	th	n,α	< 1	ic	55H34
B	0.0253 ev	a	781^h *6*	trans	53E18
	th	a	785^h *8*	osc	54G61
	th	a	771^a *6*	osc	54G61
	th	a	764^a *3*	mean life	54V08
	0.0253 ev	a	749^a *4*	trans	53C35
	0.0253 ev	a	755^a *3*	trans	53K54
	th	a	761^s *3*	mean life	54V08
	th	a	763^s *3*	mean life	54V08

h, Harwell standard (trans = transmission)
a, Argonne-Brookhaven standard
s, additional samples

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
C	1.0	t-el	−0.09 *14*	sphere	55B08
	2.4 to 3.7	el(θ)	graph	n scin	54M97
	2.7	el(θ)	graph	n scin	55L31
	4.0	t-el	0.04 *8*	sphere	55B08
	4.1	el(θ)	graph	n scin	55W27
	4.1	t	1.88	n scin	55W27
	4.1	t-$\int$el(θ)	0.08 *10*	n scin	55W27
	4.4	el(90°)	0.06 *2*	ppl	55J08
	14	t-el	0.601 *6*	sphere	55G21
	14	t-el	0.63 *5*	sphere	55P40
	14	k(t-el)†	0.08 *2*	sphere	55G21
	61 to 107	t	table		55C40
C^{12}	13 to 19	n,n′3α	table	ppl	55F35
	14	n,n′ + 4.4γ	0.24	scin pr	55B58
N	0.80 to 1.54	el(θ)	graph	pc	55F27
O	93 to 107	t	table		55C40
	109 to 169	t	table		55A24
$\mathrm{O}^{(16)}$	3.6 to 4.2	n,α	graph	ic	55S76
F^{19}	0.1 to 1	n,n′ + 0.11γ	graph	γ scin	55F32
	0.2 to 1	n,n′ + 0.20γ	graph	γ scin	55F32
	0.5 to 5	t	graph		55W38
Na^{23}	th	n,γ	0.51	15^hNa	55G43
	$\sim$0.55	n,γ	0.26 *5* mb		53A35
	2.5	t-el	0.53 *26*	sphere	55P40
	4.1	t-el	0.57	sphere	55P40
	14.1	n,2n	0.014 *2*	2.6^yNa	55P28
Mg	2.5	t-el	0.77 *25*	sphere	55P40
	2.77	(el + inel)(θ)	graph	ring	55O04
	4.1	t-el	0.78 *20*	sphere	55P40
	14	t-el	1.08 *9*	sphere	55P40

† k(t-el) = (n,2n) + 2(n,3n) − (capture)

Neutron Cross Sections continued

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
Mg$^{(25)}$	< 15	n,p	0.062	62^{s}Na	54W38
Al^{27}	1.0	t-el	0.04 *8*	sphere	55B08
	2.5	t-el	0.96 *17*	sphere	55P40
	2.7	el(θ)	graph	n scin	55L31
	3.3	t-el	0.81 *20*	sphere	55P40
	4.0	t-el	0.75 *5*	sphere	55B08
	4.1	t-el	0.78 *20*	sphere	55P40
	4.1	el(θ)	graph	n scin	55W27
	4.1	t	2.3	n scin	55W27
	4.1	t-$\int$el(θ)	0.7 *2*	n scin	55W27
	14	t-el	1.00 *1*	sphere	55G21
	14	t-el	1.13 *7*	sphere	55P40
	14	k(t-el)†	0.21 *1*	sphere	55G21
	< 15	n,p	0.042	9.5^{m}Mg	54W38
	93 to 107	t	table		55C40
Si	93 to 107	t	table		55C40
P^{31}	th	n,γ	0.19	14^{d}P	55G43
	2.5	t-el	0.7 *2*	sphere	55P40
S	2.5	t-el	0.54 *21*	sphere	55P40
	2.7	el(θ)	graph	n scin	55L31
S$^{(32)}$	2.2 to 4.0	n,p	graph	lc	55H32
	2.2 to 4.0	n,α_0	graph	lc	55H32
	2.2 to 4.0	n,α_1		lc	55H32
Cl	2.5	t-el	0.6 *3*	sphere	55P40
	4.1	t-el	0.90 *30*	sphere	55P40
	77 to 107	t	table		55C40
Cl$^{(35)}$	pile	n,γ	90 *25*	ms	55E85
A^{40}	14.8	n,α	~3x10^{-5}	lc	55B78
Ca	2.5	t-el	0.4 *2*	sphere	55P40
Sc^{45}	0.0015 to 5000 ev	t	graph		55P08
Ti	4.0	t-el	1.28 *9*	sphere	55B08
	4.1	el(θ)	graph	n scin	55W27
	4.1	t	3.7	n scin	55W27
	4.1	t-$\int$el(θ)	1.2 *2*	n scin	55W27
	61 to 107	t	table		55C40
Cr	2.5	t-el	1.4 *5*	sphere	55P40
	3.2	n,γ_i^*	table	γ scin	54S85
Cr$^{(52)}$	< 15	n,p	0.020	3.8^{m}V	54W38
Mn^{55}	th	n,γ	13.2	2.58^{h}Mn	55D17
	0.98 to 1.3	n,n$'$ + 0.85γ	graph	γ scin	55F09
	1.2	n,n$'$ + 0.13γ~1		γ scin	55V05
Fe	0.85 to 1.2	n,n$'$ + 0.84γ	graph	γ scin	55F09
	1.0	t-el	0.41 *4*	sphere	55B08
	1.2	n,n$'$ + 0.84γ	0.59	γ scin	55V05
	2.5	t-el	1.16	sphere	55P40
	3.2	n,γ_i^*	table	γ scin	54S58
	3.3	t-el	1.51 *21*	sphere	55P40

Neutron Cross Sections continued

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
Fe	4.0	t-el	1.42 *7*	sphere	55B08
	4.1	t-el	1.58 *30*	sphere	55P40
	4.1	el(θ)	graph	n scin	55W27
	4.1	t	3.6	n scin	55W27
	4.1	t-$\int$el(θ)	1.5 *2*	n scin	55W27
	4.4	el(90°)	0.076 *20*	ppl	55J08
	4.4	n,3.4n$'$(90°)	0.036 *10*	ppl	55J08
	4.4	n,2.2n$'$(90°)	0.021 *7*	ppl	55J08
	4.4	n,1.6n$'$(90°)	0.012 *6*	ppl	55J08
	4.4	n,1.2n$'$(90°)	0.020 *13*	ppl	55J08
	14	t-el	1.27 *4*	sphere	55G21
	14	t-el	1.29 *7*	sphere	55G21
	14	k(t-el)†	0.07 *3*	sphere	55G21
	93 to 107	t	table		55C40
Fe$^{(54)}$	2.5	n,n$'$ + 1.40γ	1.0	n scin	55B94
Fe$^{(56)}$	2.5	n,n$'$ + 0.84γ	1.1	n scin	55B94
	< 15	n,p	0.031	2.6^{h}Mn	54W38
Co^{59}	2.5	t-el	1.40 *11*	sphere	55P40
	3.2	n,γ_i^*	table	γ scin	54S85
Ni	th	s coh	13.1 *3*		54A40
	0.0033 to 0.33 ev	t	graph		54A40
	2.5	t-el	0.83 *12*	sphere	55P40
	3.2	n,γ_i^*	table	γ scin	54S85
	3.3	t-el	1.35 *25*	sphere	55P40
	4.0	t-el	1.35 *9*	sphere	55B08
	14	t-el	1.38 *5*	sphere	55P40
Cu	1.0	t-el	0.21 *5*	sphere	55B08
	2.5	t-el	1.58 *15*	sphere	55P40
	3.2	n,γ_i^*	table	γ scin	54S85
	3.3	t-el	1.67 *24*	sphere	55P40
	4.0	t-el	1.60 *7*	sphere	55B08
	4.1	t-el	1.68 *25*	sphere	55P40
	14	t-el	1.42 *5*	sphere	55G21
	14	t-el	1.35 *5*	sphere	55P40
	14	k(t-el)†	0.24 *2*	sphere	55G21
	61 to 107	t	table		55C40
	90	spallation for each of 18 products	table		55C23
Zn	1.0	t-el	0.10 *6*	sphere	55B08
	2.5	t-el	2.18 *50*	sphere	55P40
	3.2	n,γ_i^*	table	γ scin	54S85
	3.3	t-el	2.18	sphere	55P40
	4.0	t-el	1.69 *6*	sphere	55B08
	4.1	t-el	1.58 *30*	sphere	55P40
	4.1	el(θ)	graph	n scin	55W27
	4.1	t	3.7	n scin	55W27
	4.1	t-$\int$el(θ)	1.7 *2*	n scin	55W27
	14	t-el	1.46 *3*	sphere	55G21
	14	t-el	1.37 *7*	sphere	55P40
	14	k(t-el)†	0.11 *4*	sphere	55G21

† k(t-el) = (n,2n) + 2(n,3n) − (capture)

*Cross sections were measured for specific γ's whose energies are given in the reference.

Neutron Cross Sections continued

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
As^{75}	< 15	n,p	0.005	82^{m}Ge	54W38
Se	2.5	t-el	1.88 *17*	sphere	55P40
	14	t-el	1.40 *23*	sphere	55P40
Sr	2.6 to 6 ev	n,γ	graph	γ scin	54M87
Y^{90}	th	n,γ	< 6.5	57^{d}Y	55S77
Zr	1.5	$n,n' + 0.93\gamma$	~0.8	γ scin	55G33
	3.2	n,γ_i^*	table	γ scin	54S85
	4.0	t-el	1.56 *7*	sphere	55B08
	4.1	el (θ)	graph	n scin	55W27
	4.1	t	4.1	n scin	55W27
	4.1	t-$\int$el (θ)	1.8 *2*	n scin	55W27
	4.4	el(90°)	0.096 *24*	ppl	55W11
	4.4	n, 2.2n′ (90°)	0.009 *4*	ppl	55W11
	4.4	n, 1.6n′ (90°)	0.008 *4*	ppl	55W11
	14.1	n, p	0.18 *7*	ppl	55A40
	14.1	n,α	0.010 *10*	ppl	55A40
	14.1	n,α	0.007 *2*	pc	55R37
Zr$^{(90)}$	14.1	n,α	0.0031 *2*	2.8^{h}Sr	55B68
	14.9	n,α	0.0030 *2*	2.8^{h}Sr	55B68
Zr^{93}	th	a	1.4 *30*	osc	55P39
Zr$^{(94)}$	14.1	n,α	0.0049 *6*	9.7^{h}Sr	55B68
	14.9	n,α	0.0039 *5*	9.7^{h}Sr	55B68
Mo	2.5	t-el	1.9 *3*	sphere	55P40
	3.2	n,γ_i^*	table	γ scin	54S85
Ag	0.0253 ev	a	64.0 *5*	cryst	54A40
	th	a	63.7 *4*	osc	54G61
	th	s	4.2 *7*		54A40
	0.004 to 0.08 ev	t	graph		54A40
	0.7 to 10 ev	s/t	graph		55S63
	3.0 to 8 ev	n,γ	graph	γ scin	54M87
	1.0	t-el	1.61 *16*	sphere	55B08
	2.5	t-el	2.13 *18*	sphere	55P40
	4.0	t-el	2.05 *10*	sphere	55B08
	13 to 16	t	graph		55B14
	14	t-el	1.82 *2*	sphere	55G21
	14	k(t-el)+	0.72 *3*	sphere	55G21
Cd	10 to 1000 ev	n,γ	graph	γ scin	54M87
	1.0	t-el	0.99 *6*	sphere	55B08
	2.5	t-el	2.21 *20*	sphere	55P40
	3.2	n,γ_i^*	table	γ scin	54S85
	3.3	t-el	2.35 *35*	sphere	55P40
	4.0	t-el	2.05 *10*	sphere	55B08
	4.1	t-el	2.3 *3*	sphere	55P40
	4.1	el (θ)	graph	n scin	55W27
	4.1	t	4.1	n scin	55W27
	4.1	t-$\int$el (θ)	2.1 *2*	n scin	55W27
	14	t-el	1.95 *2*	sphere	55G21
	14	t-el	1.83 *13*	sphere	55P40
	14	k(t-el)+	0.98 *2*	sphere	55G21
In	0.0253 ev	a	190 *2*	cryst	54A40
	th	s	8.6 *24*	cryst	54A40
	0.004 to 0.08 ev	t	graph		54A40
	3.2	n,γ_i^*	table	γ scin	54S85

Neutron Cross Sections continued

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
Sn	2.5	t-el	1.65 *30*	sphere	55P40
	3.2	n,γ_i^*	table	γ scin	54S85
	3.3	t-el	1.73 *15*	sphere	55P40
	4.1	t-el	2.11 *30*	sphere	55P40
	14	t-el	1.81 *13*	sphere	55P40
Sn$^{(116)}$	< 15	n,p	0.0013	13^{s}In	54W38
Sn$^{(118)}$	< 15	n,p	0.0016	4.5^{m}In	54W38
Sb	2.5	t-el	2.11 *20*	sphere	55P40
	3.3	t-el	2.11 *20*	sphere	55P40
	4.1	t-el	2.13 *30*	sphere	55P40
	14	t-el	1.90 *16*	sphere	55P40
Te	2.5	t-el	2.00 *35*	sphere	55P40
	14	t-el	1.97 *27*	sphere	55P40
I^{127}	2.5	t-el	1.96 *25*	sphere	55P40
	14	t-el	1.88 *16*	sphere	55P40
Xe^{135}	0.01 to 0.5 ev	$\overline{\sigma v} = 866 \pm 40\ [\overline{\sigma v}(B^{10})]$			55B100
	th	a	3.47×10^6	ms	55P37
Ba	12 to 500 ev	n,γ	graph	γ scin	54M87
	2.5	t-el	0.8 *7*	sphere	55P40
	4.1	t-el	2.2 *4*	sphere	55P40
Pr^{142}	th	n,γ	18 *3*	13.8^{d}Pr	55S77
Sm	1.0	t-el	0.07 *5*	sphere	55B08
	4.0	t-el	2.09 *10*	sphere	55B08
	4.1	el (θ)	graph	n scin	55W27
	4.1	t	4.3	n scin	55W27
	4.1	t-$\int$el (θ)	2.1 *2*	n scin	55W27
	14	t-el	1.96 *5*	sphere	55G21
	14	k(t-el)+	1.04 *2*	sphere	55G21
Sm^{149}	th	n,γ	66,000	ms	55M52
Sm^{151}	th	n,γ	12,000	ms	55M52
Tb^{160}	th	n,γ	525 *100*	6.8^{d}Tb	55S78
Ho^{165}	pile	n,γ	$\geq$ 0.03	> 30^{y}Ho	55M08
Er$^{(168)}$	th	a	2.0 *4*	9.4^{d}Er	54B62
Er$^{(170)}$	th	a	8.7 *18*	7.5^{d}Er	54B62
Ta	0.35 to 0.53 ev	t	graph		55E02
	3.2	n,γ_i^*	table	γ scin	54S85
	4.1	el (θ)	graph	n scin	55W27
	4.1	t	6.4	n scin	55W27
	4.1	t-$\int$el (θ)	2.7 *2*	n scin	55W27
Ta^{182}	th	n,γ	47×10^3 *5*	5^{d}Ta	55D05
	pile	n,γ	13×10^3 *4*	5^{d}Ta	55M19
W	2.5	t-el	2.60 *25*	sphere	55P40
	4.0	t-el	2.6 *2*	sphere	55B08

+ k(t-el) = (n, 2n) + 2(n, 3n) − (capture)

*Cross sections were measured for specific γ's whose energies are given in the reference.

Neutron Cross Sections continued

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
W	4.1	el(θ)	graph	sphere	55W27
	4.1	t	6.4	sphere	55W27
	4.1	t-$\int$el(θ)	2.4 *3*	sphere	55W27
	14	t-el	2.35 *14*	sphere	55P40
Pt^{190}	th	a	90 $^{+200}_{-90}$	osc	55P39
Pt^{192}	th	a	8 *8*	osc	55P39
Pt^{194}	th	a	1.2 *9*	osc	55P39
Pt^{195}	th	a	26.8 *13*	osc	55P39
Pt^{196}	th	a	0.7 *7*	osc	55P39
Pt^{198}	th	a	4.0 *5*	osc	55P39
Au^{197}	0.0253 ev	a	96.5 *7*	cryst	54A40
	0.0253 ev	a	98.4 *9*	chopper	54E26
	th	s	8.7 *9*		54A40
	th	s	9 *2*		54E26
	0.004 to 0.08 ev	t	graph		54A40
	0.3 to 30 ev	t	graph		55W28
	2 to 16 ev	s/t	graph		55S63
	1.0	t-el	1.63 *10*	sphere	55B08
	4.0	t-el	2.75 *12*	sphere	55B08
	4.1	el(θ)	graph	n scin	55W27
	4.1	t	7.1	n scin	55W27
	4.1	t-$\int$el(θ)	2.7 *3*	n scin	55W27
	14	t-el	2.44 *2*	sphere	55G21
	14	k(t-el)†	1.76 *4*	sphere	55G21
	th	n,γ	18×10^3 *1*	S	54B99
	th	n,γ	26×10^3 *1*	3.16^d Au	55G29
Hg	2.5	t-el	2.6 *3*	sphere	55P40
	3.3	t-el	2.99 *30*	sphere	55P40
	4.1	t-el	3.36	sphere	55P40
	61 to 107	t	table		55C40
Pb	1.0	t-el	0.23 *4*	sphere	55B08
	2.5	t-el	1.69 *32*	sphere	55P40
	3.2	n,γ_i^*	table	n scin	54S85
	4.0	t-el	1.84 *8*	sphere	55B08
	4.1	t-el	1.72	sphere	55P40
	4.1	el(θ)	graph	n scin	55W27
	4.1	t	7.8	n scin	55W27
	4.1	t-$\int$el(θ)	1.9 *3*	n scin	55W27
	10 to 15	el(θ)	graph	n scin	55R20
	13 to 16	t	graph		55B14
	14	t-el	2.49 *2*	sphere	55G21
	14	t-el	2.42 *9*	sphere	55P40
	14	k(t-el)†	1.76 *4*	sphere	55G21
	61 to 107	t	table		55C40
Pb$^{(207)}$	1.4 to 3.1	n,n$'\gamma$	graph	0.82^{s}Pb	55S41
Bi^{209}	1.0	t-el	0.12 *4*	sphere	55B08
	2.5	t-el	0.62 *29*	sphere	55P40
	3.2	n,γ_i^*	table	n scin	54S85
	3.3	t-el	0.62 *15*	sphere	55P40
	4.0	t-el	1.98 *10*	sphere	55B08
	4.1	t-el	1.14 *40*	sphere	55P40
	4.1	el(θ)	graph	n scin	55W27
	4.1	t	7.9	n scin	55W27
	4.1	t-$\int$el(θ)	2.2 *3*	n scin	55W27
	14	t-el	2.53 *2*	sphere	55G21
	14	t-el	2.44 *13*	sphere	55P40
	14	k(t-el)†	1.86 *2*	sphere	55G21

Neutron Cross Sections continued

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
Ac^{227}	th	a	516	1.9^y Th	54S70
Th^{232}	th	a	7.57 *17*	osc	55S79
	th	n,γ	7.31 *12*	24^m Th	55C42
Pa^{233}	th	a	140 *20*	ms	55H55
U	0.0002 to 10^7 ev	t	graph		55BNL
	0.001 to 0.03 ev	t	graph		55L41
	4 to 800 ev	t	graph		55L41
	0.35 to 1.7 Mev	t-el	graph		55BNL
	th	a	7.07 *12*	osc	55S79
	th	s coh	9.0 *5*		55BNL
	th	s coh	9 *1*		54E25
	th	t-a	8.3 *2*		55BNL
	th	t-a	8.6 *3*		54E25
U^{230}	th	f	25 *10*		55BNL
U^{231}	th	f	400 *300*		55BNL
U^{232}	th	n,γ	300 *200*		55BNL
U^{233}	0.006 to 2000 ev	t	graph		55BNL
	0.002 to 30 ev	t	graph		55L41
	0.01 to 90 ev	t	graph		55N16
	0.01 to 40 ev	f	graph		55BNL
	0.1 to 2 Mev	f	graph		55BNL
	0.002 to 30 ev	f(rel)	graph		55L41
	0.01 to 800 ev	f(rel)	graph		55A36
	0.02 to 5 ev	f(rel)	graph		55A37
	0.0253 ev	t	610 *9*		55L41
	0.0253 ev	t	580 *20*		55N16
	0.0253 ev	a	585 *15*		55BNL
	th	a	615 *30*	ms	55K27
	0.0253 ev	n,γ	52 *2*		55BNL
	th	n,γ	53.5 *26*	ms	55K27
	0.0253 ev	f	533 *10*		55BNL
	0.0253 ev	f	515 *15*		55L41
	th	f	518 *18*		55A39
	th	f	492 *25*		55P38
	0.0253 ev	a	593 *8*	Averages adopted	
	0.0253 ev	f	524 *8*	at Geneva	55N17
U^{234}	0.3 to 4 Mev	f	graph		55L43
	0.0253 ev	a	92 *7*		55BNL
	pile	n,γ	72 *10*		55BNL
	th	f	$\le$0.65		55BNL
U^{235}	0.002 to 10^4 ev	t	graph		55BNL, 55S74
	0.006 to 6 ev	t	graph		55L41
	0.01 to 90 ev	t	graph		55N16
	0.005 to 10^4 ev	f	graph		55BNL, 55S74
	0.005 to 100 ev	f	graph		55L41

† k(t-el) = (n, 2n) + 2(n, 3n) - (capture)

*Cross sections were measured for specific γ's whose energies are given in the reference.

Neutron Cross Sections continued

Target	Energy	σ	Value of σ or $\int d\sigma$	Method	Ref.
U^{235}	0.01 to 1000 ev	f(rel)	graph		55A36
	0.01 to 4 ev	f(rel)	graph		55A37
	0.01 to 0.4 ev	f(rel)	graph		54P35
	0.2 to [illegible] ev	s	graph		55S74
	0.0253 ev	t	729 *15*		54E25, 55L41
	0.0253 ev	t	710 *20*		55N16
	0.0253 ev	a	687 *7*		55S74
	0.0253 ev	f	580 *8*		55S74
	0.0253 ev	f	638 *20*		55L41
	0.0253 ev	a	698 *10*	Averages adopted	
	0.0253 ev	f	590 *15*	at Geneva	55N17
	th	s	10 *2*		55BNL
	> 1 ev	s	11.3 *10*		55S74
U^{236}	0.67 to 4 Mev	f	graph		55L43
	th	a	6 *2*		55BNL
	pile	n,γ	9 *2*		55BNL
	pile	n,γ	24 *7*	6.7^{d}U	55A38
U^{238}	0.0002 to 400 ev	t	graph		55BNL
	0.02 to 3 Mev	n,γ	graph		55BNL
	0.0253 ev	a	2.73 *7*		55H56, 55BNL
	th	a	2.76 *6*	osc	55S79
	th	n,γ	2.75 *10*	24^{m}U	55C42
	0.0253 ev	a	2.8 *1*		54E25
U^{239}	pile	n,γ	22 *5*		55BNL
	th	f	12 *8*		55BNL
Np^{234}	th	f	900 *300*		55BNL
$>5000^{y}$ Np^{236}	pile	f	~2800		55S10
Np^{237}	0.01 to 100 ev	t	graph		55A36
	th	a	170 *20*		55BNL
	th	n,γ	170 *20*	2.1^{d}Np	55BNL
	th	f	0.019 *3*		55BNL
Np^{238}	th	f	1600 *100*		55BNL
Np^{239}	pile	n,γ	80 *15*	ms	55H55
Pu^{238}	pile	a	430 *70*		55BNL
	th	f	18 *2*		55B99
Pu^{239}	0.005 to 10^{4} ev	t	graph		55L42, 55BNL
	0.015 to 100 ev	t	graph		55R36
	0.015 to 100 ev	t	graph		55N16
	0.01 to 3 Mev	t	graph		55BNL
	0.02 to 500 ev	f	graph		55L42
	0.007 to 700 ev	f(rel)	graph		55R36
	0.01 to 10^{3} ev	f(rel)	graph		55A36
	0.008 to 5 ev	f(rel)	graph		54G58
	0.01 to 4 ev	f(rel)	graph		55A37
	0.0253 ev	t	1050 *30*		55R36
	0.0253 ev	t	1040 *30*		55N16
Pu^{239}	0.0253 ev	a	1065 *15*		55BNL
	0.0253 ev	n,γ	315 *15*		55BNL
	0.0253 ev	f	750 *15*		55BNL
	0.0253 ev	f	702 *20*		55R36
	0.0253 ev	a	1032 *15*	Averages adopted	
	0.0253 ev	f	729 *15*	at Geneva	55N17
Pu^{240}	pile	n,γ	530 *50*	ms	55B99
	th	f	< 0.5		55B99
Pu^{241}	0.01 to 8 ev	f(rel)	graph		55R36
	0.01 to 800 ev	f(rel)	graph		55A36
	th	a	1450 *300*	ms	55B99
	th	f	1100 *30*		55B99
	0.0253 ev	f	935 *40*		55R36
Pu^{242}	pile	f	< 0.3		55B99
Pu^{243}	pile	n,γ	170 *90*	ms	55B99
Pu^{244}	pile	n,γ	1.5 *3*	10^{h}Pu	55B99
Pu^{245}	pile	n,γ	260 *145*	25^{m}Am	55B99
Am^{241}	0.006 to 80 ev	t	graph		55A36
	th	a	625 *35*	osc	55P39
Cm^{242}	pile	n,γ	20 *10*		55BNL
Cm^{243}	pile	n,γ	250 *150*		55BNL
Cm^{245}	th	f	1800 *300*		55BNL, 55B99
Cm^{247}	pile	n,γ	180		55B99
Bk^{249}	pile	a	350	10^{y}Cf	54M90
Cf^{250}	pile	a	~1500	ms	54M90
Cf^{251}	pile	a	~3000	ms	54M90
Cf^{252}	pile	a	25	18^{d}Cf	54M90
E^{255}	pile	a	~40	~4^{h}Fm	55C30
Fm^{255}	pile	a	< 100	~4^{h}Fm	55C30

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3. GROUND STATE Q'S

Q values are defined by the conservation equation, $M_1 + M_2 = M_3 + M_4 + Q$ or $Q = E_3 + E_4 - E_1 - E_2$ where the M's are the rest masses and the E's the kinetic energies of the reacting particles. Ground state Q's are those measured when the product particles are left in their lowest energy states. If the most energetic emitted particle has escaped detection, the true ground state Q is greater than the value given.

The energy standard used, when clearly stated by the experimenter, is mentioned with the reference. Usually the energy measurement for only one particle, either the incident or emitted light particle, presents difficulties. It is the standard used for this particle that is given.

N. B. A uniform policy for denoting the use of enriched or monoisotopic material is now in use in all four New Nuclear Data tables. This policy is described in the section on Conventions just following the introduction. Briefly, parentheses around the A value indicate natural material, no parentheses enriched or monoisotopic material.

Reaction	Value		Source	Detector	Ref.
$H^2(p,\gamma)He^3$	5.50	3	VdG	scin	55G39
$H^2(d,n)He^3$	3.276	24	CcW	ppl	55S48
$He^3(d,\gamma)Li^5$	16.36	20	VdG	scin	54B89
$Li^{(6)}(d,He^3)He^{(5)}$	0.91	9	Cyc	s	55L24
$Li^6(p,d)Li^5$	-3.0		Cyc	pc, scin	55L09
$Li^6(t,d)Li^7$	0.986	7	CcW	s	54A35a
$Li^6(t,p)Li^8$	0.790	11	CcW	s	54A35b
$Li^{(7)}(d,\alpha)He^{(5)}$	14.26	9	Cyc	s	55L24
$Li^7(t,\alpha)He^6$	9.79	3	CcW	s	54A35c
$Be^8 \longrightarrow 2He^4$	0.090		CcW	pc	55T03
$Be^9(d,p)Be^{10}$	4.586	9	VdG	sπ	54J23
$Be^9(n,\gamma)Be^{10}$	6.80		Pile	s Cp	55G42
$Be^9(d,n)B^{10}$	4.54	6	CcW	ppl	55G24
$B^{11}(p,n)C^{11}$	-2.80	6	VdG	ppl	55A30
$B^{11}(d,n)C^{12}$	13.81		CcW	ppl	55I06
$C^{(12)}(p,\alpha)B^{(9)}$	-7.58	10	Cyc	pc	55R16
$C^{(12)}(t,\alpha)B^{(11)}$	3.85			ppl	55C17
$C^{12}(d,p)C^{13}$	2.717	10	VdG	sπ	54S101
$C^{13}(d,p)C^{14}$	5.942	11	VdG	sπ	54S101
$C^{(13)}(d,p)C^{(14)}$	5.953	10	CcW	s	54A47a
$C^{(13)}(d,n)N^{(14)}$	5.325	40		ppl	55B84
$C^{13}(d,n)N^{14}$	5.41	6	CcW	ppl	55G24
$C^{14}(d,p)C^{15}$	0.15	15	VdG	2.4^{s}C	54R38a
	0.12	5			54R38t

Reaction	Value		Source	Detector	Ref.
$N^{(14)}(\alpha,n)F^{(17)}$	-4.8	1	Cyc	pc	55D01
$N^{15}(p,n)O^{15}$	-3.539	8	VdG	BF_3	55K28
$O^{(16)}(d,p)O^{(17)}$	1.915	10	VdG	sπ	54S101
$O^{17}(d,\alpha)N^{15}$	9.807	12	CcW	s	54P39
$O^{17}(d,p)O^{18}$	5.821	10	CcW	s	54A47
$O^{18}(p,\alpha)N^{15}$	3.967	9	CcW	s	54A47
$O^{18}(d,p)O^{19}$	1.730	8	CcW	sd	54M89
$O^{18}(d,p)O^{19}$	1.735	8	VdG	s	55H28
$F^{19}(t,p)F^{21}$	6.269	30	VdG	s	55J15
$F^{19}(t,p)F^{21}$	6.03	10		ppl, scin	55B26
$F^{19}(p,n)Ne^{19}$	-4.027	8	VdG	BF_3	55K28
$F^{19}(\alpha,n)Na^{22}$	-2.0		Cyc	pc	55D04
$Ne^{20}(d,p)Ne^{21}$	4.526	9	CcW	s	55A41
$Na^{23}(n,\gamma)Na^{24}$	6.96		Pile	s Cp	55G42
$Na^{23}(p,n)Mg^{23}$	-4.841	10	VdG	BF_3	55K28
$Na^{23}(\alpha,n)Al^{26}$	-2.9		Cyc	pc	55D01
$Mg^{(24)}(d,\alpha)Na^{(22)}$	1.953	12	CcW	s	55B32
$Mg^{25}(p,n)Al^{25}$	-5.084	25	VdG	BF_3	55K28
$Al^{27}(p,\alpha)Mg^{24}$	1.61	4	Cyc	ppl	54G55
$Al^{27}(p,n)Si^{27}$	-5.584	10	VdG	BF_3	55K28
$P^{31}(\gamma,n)P^{30}$	-12.33	5	β tron	2.5^{m}P	55B82
$P^{31}(p,n)S^{31}$	-6.03	15	Cyc	ppl	55R02
$P^{31}(\alpha,p)S^{34}$	0.5		Cyc	scin	55P03
$P^{31}(\alpha,n)Cl^{34}$	-5.7		Cyc	pc	55D04

Ground State Q's continued

Reaction	Value		Source	Detector	Ref.
$S^{(32)}(n,\gamma)S^{(33)}$	8.63	4	Pile	s Cp	55G42
$S^{(32)}(\alpha,p)Cl^{(35)}$	-2.3		Cyc	scin	55P03
$S^{34}(p,n)Cl^{34}$	6.1		Cyc	ppl	55A03
$Cl^{(35)}(\gamma,n)Cl^{(34)}$	-12.35	35	β tron	32^{m}Cl	55D30
$Cl^{(35)}(n,\gamma)Cl^{(36)}$	8.55	4	Pile	s Cp	55G42
$A^{36}(\alpha,p)K^{39}$	-1.28	3	Cyc	ppl	55S27
$A^{(40)}(n,\alpha)S^{(37)}$	-2.5	1	CcW	ic	55B78
$A^{(40)}(\gamma,p)Cl^{(39)}$	-12.44		β tron	55^{m}Cl	54M99
$A^{(40)}(\gamma,n)A^{(39)}$	-10.25		β tron	BF$_3$	54M99
$A^{40}(\alpha,p)K^{43}$	-3.36	3	Cyc	ppl	55S27
$K^{(39)}(\gamma,n)K^{(38)}$	-13.00		β tron	8^{m}K	55D30
$K^{(39)}(\alpha,p)Ca^{(42)}$	-0.19	7	Cyc	pc	55S07
$K^{(41)}(\alpha,p)Ca^{(44)}$	0.98	10	Cyc	pc	55S07
$Ca^{(40)}(d,n)Sc^{(41)}$	-0.60	5	Cyc	ppl	55P07
$Ca^{(43)}(d,p)Ca^{(44)}$	9.07	7	Cyc	pc	55S07
$Ca^{48}(d,p)Ca^{49}$	2.80	30	Cyc	scin	54W33
$Fe^{(54)}(\gamma,n)Fe^{(53)}$	-11.90	7	β tron	9^{m}Fe	55D30
$Fe^{54}(\gamma,n)Fe^{53}$	-13.65	5	β tron	9^{m}Fe	55B88
$Fe^{54}(d,p)Fe^{55}$	7.18	7	Cyc	pc	55M24
$Fe^{56}(d,p)Fe^{57}$	5.49	6	Cyc	pc	55M24
$Fe^{57}(d,p)Fe^{58}$	7.89	7	Cyc	pc	55M24
$Co^{59}(d,p)Co^{60}$	5.283	8	VdG	sπ	54F27
$Cu^{63}(p,n)Zn^{63}$	-4.147	8	VdG	BF$_3$	55K28
$Cu^{(63)}(\gamma,n)Cu^{(62)}$	-10.54	4	βtron	10^{m}Cu	55D30
$Cu^{(65)}(p,n)Zn^{(65)}$	-2.137	5	VdG	BF$_3$	55K28
$Zn^{(64)}(\gamma,n)Zn^{(63)}$	-11.58	6	β tron	38^{m}Zn	55D30
$Zn^{(64)}(\gamma,2n)Zn^{(62)}$	-20.35	35	β tron	9^{h}Zn	55D30
$Zn^{68}(d,p)Zn^{69}$	4.16	15	Cyc	scin	54E22
$Ge^{(70)}(\gamma,n)Ge^{(69)}$	-12.1	2	β tron	40^{h}Ge	55D30
$Ge^{(76)}(\gamma,n)Ge^{(75)}$	-9.3		β tron	82^{m}Ge	55D30
$Rb^{85}(d,p)Rb^{86}$	6.2	3	Cyc	scin	54W33
$Rb^{87}(d,p)Rb^{88}$	3.75	20	Cyc	scin	54W33
$Sr^{84}(d,p)Sr^{85}$	5.25	30	Cyc	scin	54W33
$Sr^{86}(d,p)Sr^{87}$	6.26	20	Cyc	scin	54W33
$Sr^{88}(d,p)Sr^{89}$	4.29	15	Cyc	scin	54W33

Ground State Q's continued

Reaction	Value		Source	Detector	Ref.
$Y^{89}(d,p)Y^{90}$	4.41	5	Cyc	scin	54W33
$Zr^{(90)}(\gamma,n)4^{m}Zr^{(89)}$	-12.20	6	β tron	4^{m}Zr	55D30
$Zr^{92}(d,p)Zr^{93}$	4.46	5	Cyc	scin	54W33
$Zr^{94}(d,p)Zr^{95}$	4.19	5	Cyc	scin	54W33
$Mo^{92}(d,p)Mo^{93}$	5.63	5	Cyc	scin	54W33
$Mo^{96}(d,p)Mo^{97}$	4.51	30	Cyc	scin	54W33
$Mo^{97}(d,p)Mo^{98}$	6.06	10	Cyc	scin	54W33
$Ag^{(107)}(\gamma,n)Ag^{(106)}$	-9.57	7	β tron	24^{m}Ag	55B88
$Ag^{(109)}(\gamma,n)Ag^{(108)}$	-8.78	4	β tron	2^{m}Ag	55D30
$Cd^{112}(d,p)Cd^{113}$	4.10	9	Cyc	scin	54W33
$Cd^{114}(d,p)Cd^{115}$	3.52	15	Cyc	scin	54W33
$Sn^{120}(d,p)Sn^{121}$	3.92	7	Cyc	scin	54W33
$Sn^{124}(d,p)Sn^{125}$	3.52	7	Cyc	scin	54W33
$Te^{124}(d,p)Te^{125}$	4.25	7	Cyc	scin	54W33
$Te^{(125?)}(d,p)Te^{(126?)}$	5.0	2	Cyc	scin	54W33
$I^{127}(d,p)I^{128}$	4.35	5	Cyc	scin	54W33
$Cs^{133}(d,p)Cs^{134}$	4.50	10	Cyc	scin	54W33
$La^{(139)}(d,p)La^{(140)}$	2.87	10	Cyc	scin	54W33
$Ce^{140}(d,p)Ce^{141}$	3.17	10	Cyc	scin	54W33
$Ce^{142}(d,p)Ce^{143}$	2.86	7	Cyc	scin	54W33
$Pr^{141}(d,p)Pr^{142}$	3.42	30	Cyc	scin	54W33
$Nd^{142}(d,p)Nd^{143}$	3.79	8	Cyc	scin	54W33
$Sm^{(144)}(\gamma,n)Sm^{(143)}$	-9.60	5	β tron	8^{m}Sm	55D30
$Sm^{154}(d,p)Sm^{155}$	3.36	30	Cyc	scin	54W33

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Ground State Q's continued

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4. MASS DIFFERENCES AND RATIOS

Differences are given in millimass units

	Value		Ref.
Li^6/Li^7	0.857342	*2*	54H63
C^{12}/C^{13}	0.9228447	*20*	55M58
S^{32}/S^{34}	0.9412462	*22*	55M58
S^{32}/S^{33}	0.9696909	*32*	55M58
$\frac{Cl^{36}-Cl^{35}}{Cl^{37}-Cl^{35}}$	1.00168	*40*	55A23
K^{39}/K^{41}	0.951225	*7*	54H63
$3Cu^{63}-Os^{189}$	-169.8	*9*	54P34
$3Ni^{64}-Os^{192}$	-179.7	*6*	54P34
$\frac{Se^{76}-Se^{75}}{Se^{80}-Se^{75}}$	0.199566	*30*	55A14
Br^{79}/Br^{81}	0.975300	*7*	54H63

	Value		Ref.
Rb^{85}/Rb^{87}	0.977017	*5*	54H63
	0.977016	*5*	54T35
$2Ru^{98}-Pt^{196}$	-154.0	*6*	54P34
$2Ru^{99}-Pt^{198}$	-152.6	*4*	54P34
$Os^{189}-3Cu^{63}$	+169.8	*9*	54P34
$Os^{192}-3Ni^{64}$	+179.7	*6*	54P34
$Pt^{196}-2Ru^{98}$	+154.0	*6*	54P34
$Pt^{198}-2Ru^{99}$	+152.6	*4*	54P34

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